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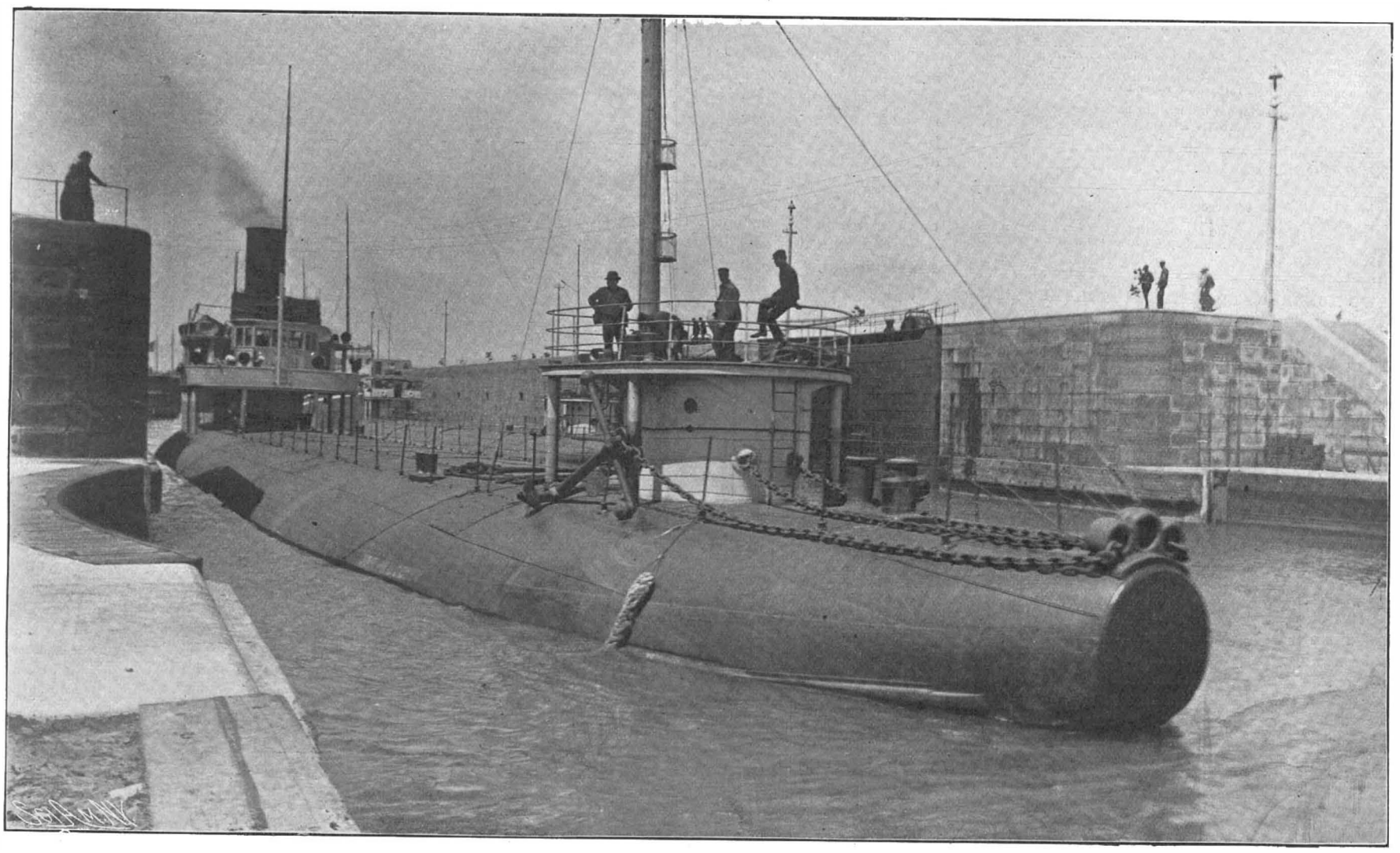
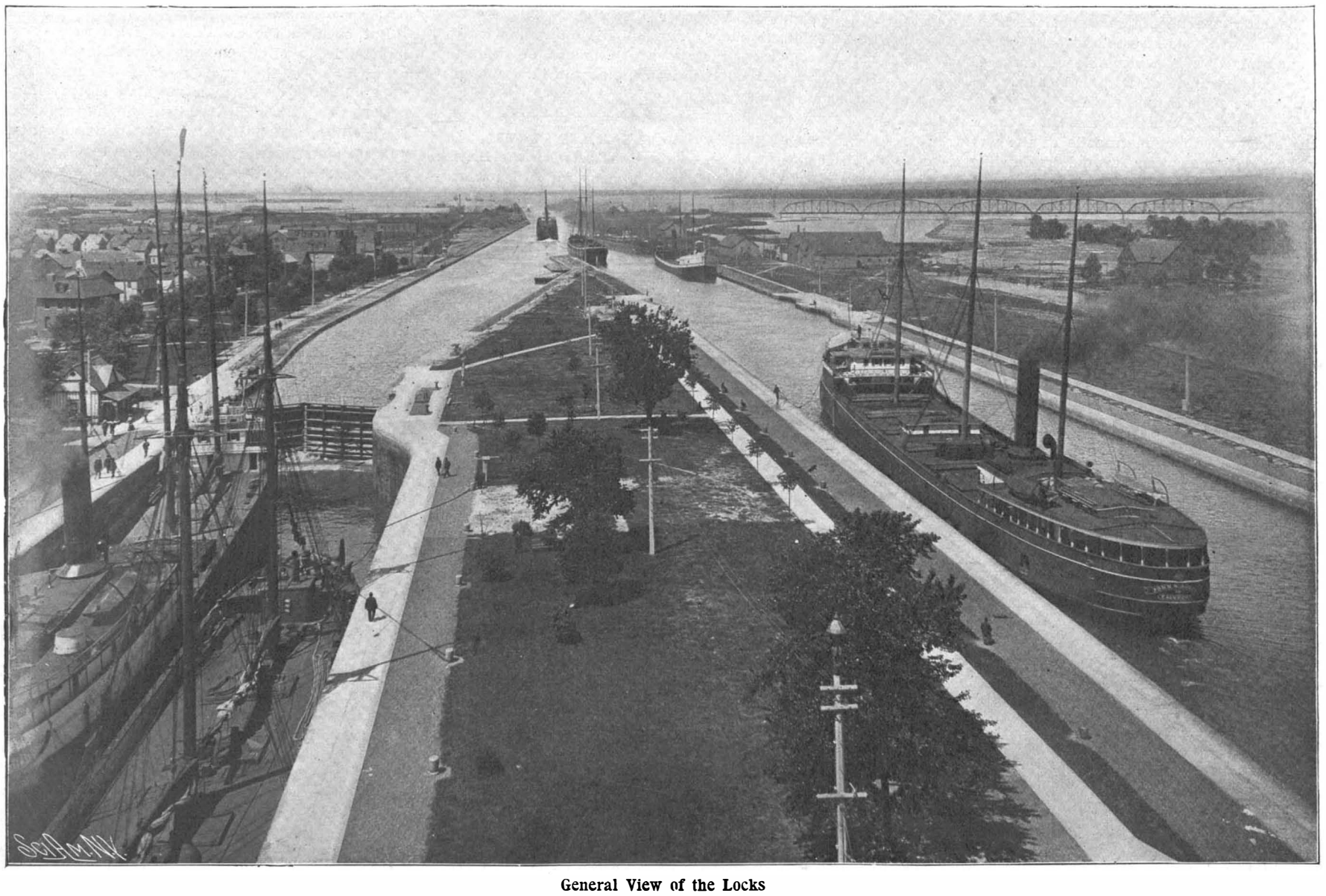


Poe Lock. Sault Ste. Marie Canal.



General View of the Locks

FIFTIETH ANNIVERSARY OF THE OPENING OF THE SAULT STE. MARIE CANAL.—[See page 427.]

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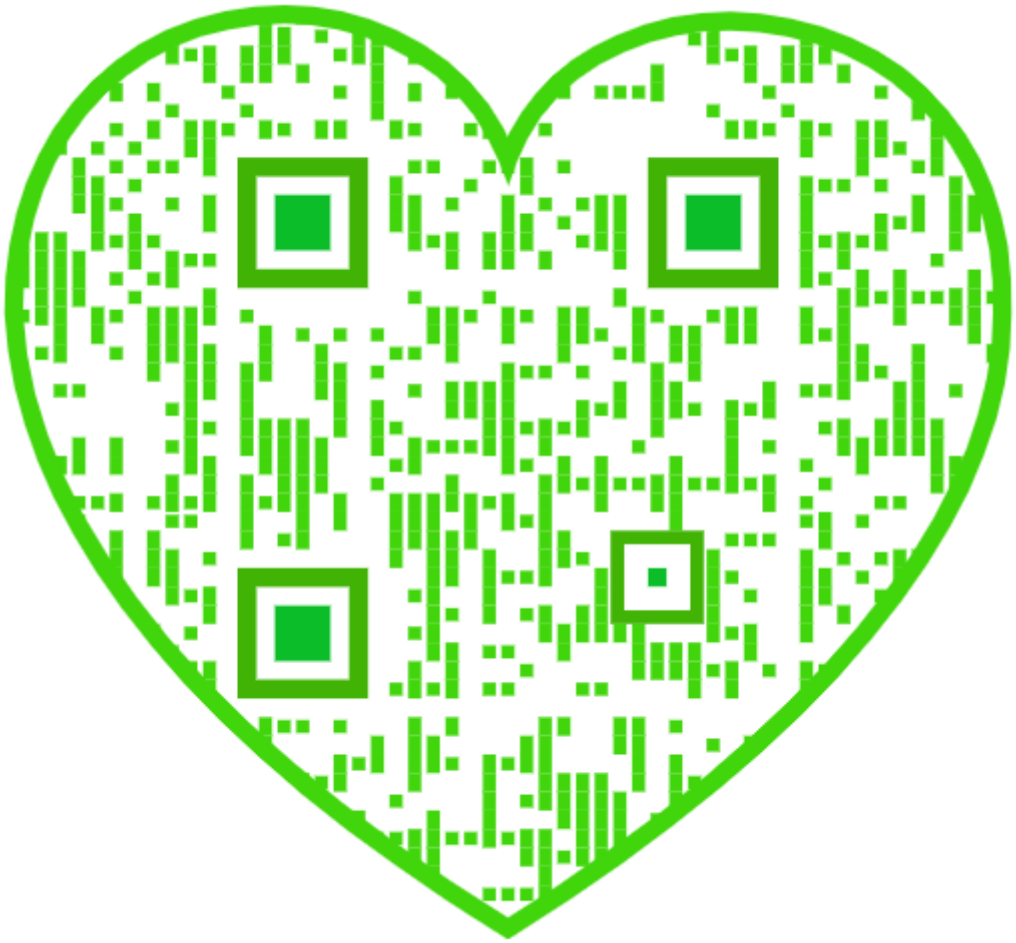

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NEW YORK, SATURDAY, JUNE 6, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE TWO HUNDRED AND FIFTIETH ANNIVERSARY OF NEW YORK CITY.

Although it might have been possible to find a more sentimental event than the incorporation of the city on which to base the recent 250th anniversary of New York, such, for instance, as the landing of the first settlers, or the purchase of Manhattan Island by the Dutch for sixty guilders, it cannot be denied that the incorporation marks the actual birth of the city and is the logical landmark from which to measure its life and progress among the great cities of the world. There is, of course, an unavoidable sameness in all such celebrations, but in this particular case there were circumstances which gave to the celebration a special interest, and served to draw the attention of the civilized world. In all the world's history there is no parallel to the extraordinary rapidity of the growth of New York city in wealth, extent and population. In 1653 we find a little settlement of 1,500 souls, housed in a few modest homes in a clearing at the southerly end of forest-covered and rocky Manhattan Island. Two hundred and fifty years later, New Amsterdam is represented by splendid New York, with a population of close upon four millions of souls. The forests of Manhattan have been swept away, the swamps filled in, the rocky hills laid low, and the island covered from end to end and from river to river with majestic buildings devoted to commerce and industry, with the magnificent homes of its successful merchants and financiers, and the lofty apartment and tenement homes of its busy toilers, while its streets and avenues are seamed and undermined with a veritable network of railways for the quick transit of its inhabitants.

It would be a distinction for any city to have grown in two and a half centuries from a mere village to be the second greatest metropolis of the world. But New York city has been favored by holding a commanding geographical position which in itself has undoubtedly given it a prestige unique among the cities of the world. Most fitly has it been named the gateway of the western hemisphere, for into its harbor and outward through its radiating network of railways, has poured and been distributed that marvelous stream of cosmopolitan humanity which has contributed so largely to our growth in population, and to the development of that national versatility to which our commercial success is largely due. New York city has increased by a steady influx from every quarter of the compass; from the East by the immigration of foreign races, a large percentage of which has made New York its home, while from the West, North, and South it has grown by the steady inflow of the more energetic among its own native population, whose ambition has drawn them to a city that holds out promises of wealth and fame, promises, by the way, that it frequently redeems with a most lavish hand.

Although the municipal history of New York city has been extremely turbulent and much of it discreditable, allowance must be made for the fact that the city is so largely cosmopolitan, and that it has ever been the favorite hunting ground of the political adventurer. When we remember how many thousands of immigrants settle each year within its boundaries, and that these people, many of whom cannot even speak the language of the country, are early invested with the privileges of the franchise, the marvel is not that the city should have had so much, but rather that it should have had so little, that is disastrous and humiliating written in its records. Moreover, there is much promise for the future in the fact that whenever the best elements among the citizens of New York city have set themselves to reform municipal abuses, they have been easily able to obtain full control and have proved, as at present they are proving, that the city can conduct its affairs righteously and justly and in the best interests of the individual citizen.

It is pardonable at a time like the present to make a forecast of the future; and it may safely be said that if the city continues to grow at the present astonishing rate, it will hold, sooner than many of us expect, the proud position of being the leading metropolis of the world, pre-eminent not merely for its numbers, extent, and wealth, but also, let us hope, for the purity of its government and the high ideals and political integrity of its citizens.

REMARKABLE EFFICIENCY OF ELEVATED RAILWAY ELECTRIC SERVICE.

That electric traction is more economical and in every way more efficient than steam traction for rapid transit on a road of the great traffic and very frequent stops of the Manhattan Elevated Railroad in this city, needs no demonstration at this stage of electrical development. Yet, the economical results shown in the operation of this system since the installation of electric traction have more than borne out the predictions made at the time that the change was determined upon. The average speed of the trains has been accelerated about twenty-five per cent, which, of course, means that the capacity of the road has been increased to that extent. The total time for any given trip over the line being twenty-five per cent less, it is possible to run, under the same headway, just twenty-five per cent more trains than formerly. The gain in speed is chiefly in the rapid acceleration at starting, and quicker stopping due to the introduction of the Westinghouse air brake. The speed of the train when under way is also higher than it was when steam locomotives were in use. There is a further gain due to the fact that in the busy hours the trains are six cars instead of five cars in length, there being a further increase in capacity of twenty per cent from this cause alone. The total number of persons carried daily by the elevated system has now reached the great average of 800,000. To work this service requires the exercise of 45,000 electrical horse power. No such results as these could be accomplished by the old steam engines, whose greatest tractive effort was equal to about 7,000 pounds pull on the drawbar. The maximum tractive effort exerted under the present system, in which the motors are distributed throughout the train and a much greater load is therefore available for adhesion, is about 20,000 pounds. The remarkable increase in the starting power and in the brake power is not secured, however, without some expense of personal convenience, many of the motormen seeming to be rather slow in learning to handle the greater power which they have at command with proper discretion. The starting and stopping is more jerky and irregular than it need be; although with every added month of operation there is a marked improvement as the incapable motormen are being weeded out.

COST OF HIGH-SPEED STEAMSHIP TRAVEL.

In connection with negotiations between the British Admiralty and the Cunard Company for two new vessels of 25 knots average sea speed, an investigation was made of the comparative size, horse power and cost of first-class Atlantic passenger steamers designed to steam at speeds that increased in each vessel by one knot per hour. Estimates were made of the size, cost of construction and cost of operation of steamers of from 20 to 26 knots per hour, and the investigation was based upon a 20-knot steamer 600 feet in length, with engines of 19,000 horse power and consuming in a single trip across the Atlantic 2,228 tons of coal. Such a vessel would cost $1,750,000 and it would receive from the government an annual subsidy of $45,000. A 23-knot steamer, built under the same government conditions as to subsidy, would be 690 feet long, would require 30,000 horse power; would cost $2,875,000 and would require an annual subsidy of $337,500. A 25-knot steamer would be 750 feet long, would require 52,000 horse power; would cost $5,000,000, and would require an annual subsidy of $750.000, while a 26-knot steamer would have to be 780 feet long, would require 68,000 horse power, would cost $6,250,000, and an annual subsidy would have to be paid by the government of $1,020,000.

In the machinery department of a 20-knot vessel 100 men would be required; in a 23-knot vessel, 150 men; in a 25-knot vessel 260 men, while for a 26-knot ship there would have to be 340 engineers, oilers, etc. It will thus be seen at what an increasing rate the first cost and the operating expenses of these high-speed steamers run up. For the increase in speed of a single knot an hour, or 24 knots per day, it is necessary to add 30 feet to the length of a 25-knot ship, 16,000 horse power to the motive power and 1,255 extra tons of coal must be put into the bunkers. The displacement must be increased by 3,100 tons; 80 more men must be added to the engine and boiler room staff, and the total cost will be increased by $1,250,000.

THE ABUSE OF A NOBLE SPORT.

It required only a series of shocking fatalities such as happened in the recent Paris-Madrid automobile race to bring the governments concerned and the general public to their senses, and demonstrate to what criminally absurd lengths the sport of automobile racing has been carried. On the other hand it is well to remember that in the presence of a great disaster there is always a risk of panic legislation, and it is to be hoped that, while the Paris-Madrid horror will result in the abolition of road racing under the extremely dangerous conditions that have hitherto been allowed, it will not lead to the prohibition of such racing when it is governed by reasonable restrictions as to the contestants, and surrounded by absolute safeguards for the general public.

The French government has sanctioned and, indeed, officially promoted these contests on the ground that it was automobile racing that was largely responsible for the rapid development of the automobile industry in France. This is probably true; for it necessarily follows that in endeavoring to produce cars that will stand the enormous strain and the tax upon the endurance, of these long-distance road races, there is a stimulus both upon the inventor and builder such as could be afforded by no other means. The miserable mistake and folly of the whole business is in permitting the races to extend over such great distances that it has become impossible to adequately police the course and surround the contestants with adequate safeguards. In the present system there was absolutely no tax upon the weight or power of the cars. Any amateur who possessed sufficient money and foolhardiness was at liberty to have built for him and to run a veritable locomotive over the course. This, in itself, was an invitation to disaster; but when he was allowed to send this machine crashing along the public highways between lines of densely packed peasantry at speeds of from 50 to 80 miles an hour, the conditions were ripe for slaughter.

If automobile races are to be conducted in the future—and seeing that these races are a direct stimulus and benefit to the industry, it is certainly desirable that they should continue to be held—they must take place either on specially constructed and carefully guarded courses, or on stretches of public highway from which the public is absolutely excluded. Moreover, the contestants should be limited to successful candidates who have been selected after a series of trial races. This is the plan that is to be followed in the forthcoming races in Ireland, where instead of several hundreds there will be but a dozen competitors and where the course, which is of limited length, will be kept guarded by some 7,000 or 8,000 of the constabulary.

But even in the case of the Irish race it will be impossible to eliminate one inevitable cause of disaster, namely, the unevenness and curvature of a public highway. When a machine is traveling at a speed of 60 to 80 miles an hour, slight inequalities in the surface, which would not be noticeable at 30 or 40 miles an hour, become, by virtue of the terrific jar imparted to the machine, a positive source of danger; while in rounding curves which have no banking on the outer side a heavy cross strain is thrown on the tires, and should the speed exceed a certain rate, either the tires will skid or the machine will be overturned by the great centrifugal force set up.

Perhaps it may prove that these difficulties (which are inherent, if the public highways are to be used by high speed vehicles) are not unmixed disadvantages; for they may lead to the recognition of the fact that if we are to utilize the high speed possibilities of the automobile, we must solve the problem along the lines upon which we have so successfully solved it in railway travel, and build special roadbeds for high speed automobiles. The indications are that the time is not far distant when the increase in automobiling will be such as to guarantee the construction of special roads with perfectly true surface, with small curvatures properly banked on the outside, and with ample protection, by the exclusion of all grade level crossings, against collisions with passenger and vehicular traffic.

We close with a brief summary of the race and the times made by the leading cars.

The first stage of the ill-fated race, from Paris to Bordeaux, a distance of 300 miles, was covered by the racers early on Sunday morning, May 24, with so many fatalities and serious accidents to the participants and onlookers that the running of the two remaining stages was forbidden by the French and Spanish governments. Seven were killed and three others critically injured as a result of the terrific speed and the failure of the authorities to keep the road clear. Marcel Renault, the winner of the Paris-Vienna race last year, and two chauffeurs on two other racers, were killed by their cars upsetting when their drivers tried to avoid obstacles in the road, while two

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women and two soldiers who got in the way were run down and killed instantly.

The best time from Paris to Bordeaux was made by Gabriel on a Mors racer. His running time was 5 hours 13 minutes 31 1-5 seconds, which made his average speed about 66 miles an hour. Louis Renault, on a Renault car, was second in 5 hours 22 minutes 59 seconds; and J. Salleron on a Mors, third, in 5 hours 46 minutes 1 4-5 seconds. Jarrott, the Englishman, on a De Dietrich, arrived fourth about five minutes later.

PROF. GOODSPEED ON SECONDARY RADIATION INDUCED BY X-RAYS.

The first printed statement issued over his own signature by Prof. Arthur W. Goodspeed of the University of Pennsylvania concerning secondary radiation induced by X-rays since his announcement of important discoveries in this direction is published in the university's official organ, The Pennsylvanian. The article reads:

Having occasion last winter to examine critically some radiographic records, I was surprised to find the clear outlines of some metallic bodies that had been behind the plate during exposure. This recalled that I had been consulted once by somebody who had found similar anomalies, and that I had been unable to throw any light upon the subject. For obvious reasons, I determined now to spare no trouble to hunt down the cause of the effect which I had observed, and after a series of upward of one hundred progressive experiments I was convinced that when an X-ray tube is in operation not only is every particle of matter which is impinged by the X-rays secondarily radiant, but that also in some cases this secondary radiation had in all probability imparted activity of some sort to air particles and to portions of the wall which had not been impinged directly by the primary rays.

The cause, then, of the impressions on the plate of articles behind it was established. All of the later experiments leading up to this conclusion had been made with the Crookes tube completely inclosed in a dark box, eliminating thereby every trace of fluorescent emanations which one usually does not take the trouble to cut off and which are always emitted by the glass with which the bulb is made.

Next, from a portion of the space outside the box, the X-rays, which, of course, passed freely through the wood, were completely cut off by heavy lead plates, properly placed on the top of the box, and it was on these plates, screened thereby from the X-rays, that the radiographic films employed for receiving the records were placed. Above this, and to one side, freely accessible to the X-rays, the various bodies to be tested for secondary activity were arranged, including zinc, brass, wood, my hand, and a variety of articles too numerous to mention. In every case unmistakable evidence of secondary action appeared upon the plate.

Presuming, of course, that others besides myself may have been working along similar lines, I proceeded to look up carefully the literature on the subject in order, if possible, to determine what parts of the investigation, if any, might claim priority as well as originality. Two Frenchmen, Perrin and Sagnac, I found had demonstrated the property of secondary activity induced by the X-rays, and along some lines of investigation had given some interesting quantitative values; and still a third, Frenchman, Guillox, had demonstrated the possibility of using the hand as a secondary source.

None of these three, however, seems to have excluded the optical fluorescence which always accompanies the X-rays, unless special care is taken to cut it off, as already explained. Inasmuch as I found that an Englishman of the name of Townsend had demonstrated that some differences in the numerical values given by Perrin and by Sagnac must have been due to a difference in the primary rays they employed, it seemed to me that putting everything in absolute darkness, from an optical point of view, and then experimenting in the night, thereby cutting off every trace of optical light, was a distinct step in advance of the work of the men referred to.

In brief, then, it has been shown possible to produce secondary radiograms on a sensitized film, inclosed in a perfectly dark receptacle, by means of absolutely invisible emanations from various articles, including the human body, which have been excited by X-rays generated within a black box in a perfectly dark room.

This apparently startling conclusion loses much of its mystery when we contemplate that it is entirely proved at the present time that only about 2 per cent of the radiant energy that comes to us from the sun is capable of affecting the human eye. That bodies on the earth, therefore, while bathed in a portion of the other 98 per cent may be capable of diffusing some of it is what any thoughtful person will admit.

A piece of white paper in a beam of sunlight, or even in a space diffusely illuminated, as is the room of a house, receives a small portion of the 2 per cent of the total energy incident upon its path, and diffuses again a small portion of what it receives, thereby making it visible to the eye. Why, then, might we not expect that a piece of zinc or copper favorably posed to receive a portion of the other 98 per cent, i. e., of the dark energy, should be capable of diffusing some part of that in such a way as to be objectively visible to some appropriately devised apparatus for observing it?

It is to be noted in passing that the most favorable location for getting some of the 98 per cent without some of the visible 2 per cent is in a dark room. We have been using the word dark, of course, as applied to the human eye. It is quite possible, to my mind—entirely probable—that a mouse, and very likely a cat, could, if it had the proper intelligence, give us valuable assistance in rooms to us totally dark which are doubtless to them comfortably illuminated.

In connection with the work just referred to, a somewhat painful personal experience seems to me to be suggestive as to the possible cause of the well-known inflammation which sometimes follows prolonged exposure to the X-rays. A year ago I had occasion to sleep in the same room in which experiments had been conducted during the day. At the end of that time I left town, but developed at once an aggravated attack of inflammation of the eyes and throat, which yielded to treatment after a few days. During the first week of this month again I found it convenient to sleep in the same room where I had been conducting experiments during the day and evening. At the end of about the same time all the symptoms reappeared with which I had suffered a year ago, with same result—on changing sleeping rooms the difficulty at once disappeared.

In drawing conclusions from these experiences, it must be noted that no trouble has been experienced in the meantime nor before, although I have frequently, during the last six weeks, spent several hours each day for a week or two at a time around the X-ray apparatus. In the night the room had been nearly or quite closed, preventing free air circulation, and the potent protection of eyeglasses was wanting.

I am forced, under the circumstances, to believe strongly that the immediate cause of the troublesome inflammations was the secondary emanations from the air or bodies in the room, or the human body itself, rather than the primary X-rays. This theory would, of course, necessitate the assumption that the activity lasts for an appreciable time after the exciting cause has ceased.

To prove this by objective experiment would indeed be difficult, since the ions developed by the passage of the X-rays through the air are, of course, present for a considerable time after the cessation of the rays, and the electroscope, which would be expected to indicate the activity sought, would be discharged by these ions, and we would still be in the dark.

ALKALI MANUFACTURE BY ELECTRICITY FROM NATURAL SALTS.

The first six months' working of the electrolytic process of manufacturing alkali from natural salts in England has proved so successful that a wider adoption of the process is to be carried out. The general system of manufacturing the alkali from the natural product is by the decomposition of the two fundamental constituents—chlorine and soda—by complicated and not expensive chemical processes, in which sulphur plays an important part. The methods invented by M. Leblanc, a French chemist, more than 120 years ago have been generally followed ever since that time. During the past few years, however, Mr. James Hargreaves and Mr. Thomas Bird have been conducting an elaborate series of experiments, with the object of devising some simpler and more economical method of bringing about the decomposition of the salt with the aid of electricity.

For the purposes of these experiments a small plant was laid down at Middlewich, Cheshire, the center of the salt industry of England. The salt abounds in the form of brine in large subterranean lakes. In the electrolytic process, the brine after being pumped to the surface is conducted into rectangular cells, through which is passed a strong current of electricity. The effect of this is to release the chlorine, which escapes in the form of gas into pipes, and is conducted into other chambers, where it is brought into contact with lime, and produces chloride of lime. The solution of sodium which is left in the cells passes out through a diaphragm, and is converted by a bath of steam into soda solution. By a very simple arrangement in the construction of the chambers, carbonic acid gas, from the furnaces which supply the power, meets this soda solution and its properties are absorbed, with the result that a strong solution of carbonate of soda is formed. Then it flows away into vats, where the soda gradually hardens into crystals, and the processes are complete. It is then only necessary for the great blocks of soda carbonate to be broken up to a suitable size for sale.

A battery of only 56 cells has been at work, but the profit upon six months' experimental work is $37,500. The main features of this new process are economical production, with very little waste, and the reduction in price to the consumer of the finished products.

SCIENCE NOTES.

The anti-diphtheria serum discovered by Prof. Roux, of the Pasteur Institute, is now being made in the form of lozenges for use during convalescence. The professor had observed that bacilli found in the mouths of patients several weeks after recovery were liable to convey the disease to others. The lozenges overcome this and also render preventive inoculation unnecessary.

The Greeks and Romans paid special attention to the physical culture of their youth, to public water supplies and baths, and Athens and Rome were provided with sewers early in their history. During the middle ages, sanitation received a decided check. Ignorance and brutal prejudice prevailed and this was the most unsanitary period in history. Most European towns were built compactly and surrounded by walls. The streets were narrow and winding, and light and air were excluded. The accumulation of filth was frightful. Stables and houses were close neighbors. The dead were buried within the churchyards or in the churches. Wells were fed with polluted water. All conditions were favorable for the spread of infectious diseases, and in the fourteenth century alone the Oriental or bubonic plague—the Black Death of recent historians—carried off a fourth of the population of Europe. The birth-rate was much less than the death-rate normally. The cities had to be continually repopulated from the country. These sentences from a review in Science of new works on sanitation in our own times illustrate, by provoking a comparison, the improvement in our day.

H. D. Richmond points out that it is quite fallacious to endeavor to test the acidity of milk with litmus-paper, since it is possible to condemn all fresh milk as the result of applying that test. Litmus-paper may be either red containing only the acid, or blue containing the acid with such an amount of alkali that no red ions are formed, or at some intermediate stage. If those papers be used to test a partially neutralized mixture of acids of various strength, contradictory results may be obtained. Phosphoric acid is a good example of three different acidities in one molecule; the first acidity is strong, the third is very weak, and the second is intermediate between the two, and about equal in strength to the acid of litmus. It has been shown that milk contains phosphates with the third acidity completely neutralized and the second only partly so, and therefore milk is an excellent substance to show the peculiar behavior of litmus. If blue litmus-paper be dipped into milk, the blue litmus, having the acid completely neutralized, is more alkaline than the milk, and the two tend to come into a condition of equilibrium by a portion of the alkali of the litmus passing to the milk; the consequence is that the litmus becomes less alkaline and turns slightly red. If red litmus-paper, which is more acid than the milk, be used, alkali will tend to pass from the milk to the litmus, and turn it slightly blue. This is the so-called amphoteric reaction. A litmus-paper of some intermediate stage would be unaffected.—Chemical News.

A German chemist, Herr Gerold, has discovered a means of preventing the ill-effects which sometimes arise from the excessive use of tobacco, which is liable to produce attacks of vertigo, a particular form of dyspepsia, palpitation, and diseases of the chest. His procedure consists in steeping the leaves of tobacco, before being made up, in a solution of tannic acid, which combines with the nicotine and forms a substance quite inactive and harmless. In order to increase the flavor of the tobacco, it is then treated with a decoction of marjoram. The flavor of the tobacco prepared as above described differs in no way from that of ordinary tobacco; and experiments made with it on weasels, frogs, and even human beings, have demonstrated that its use produces no toxic effects on the organism. The pressure of the blood remains normal, the heart beats regularly, and the paralysis which overtakes animals who have been poisoned with nicotine is entirely obviated. Our contemporary adds that all smokers will hail with satisfaction the discovery of Herr Gerold. We fear that, as a smoker, we can scarcely agree with this optimistic statement. Supposing that Herr Gerold succeeds in removing all the nicotine, what is left? We doubt that the vast proportion of tobacco smokers suffer from consequent dyspepsia, palpitation, and diseases of the chest, and believe that they will prefer to continue the use of tobacco than to adopt Herr Gerold's substitute. If, on the other hand, a smoker does suffer as our contemporary suggests, he would do well to refrain from the "noxious weed" altogether.

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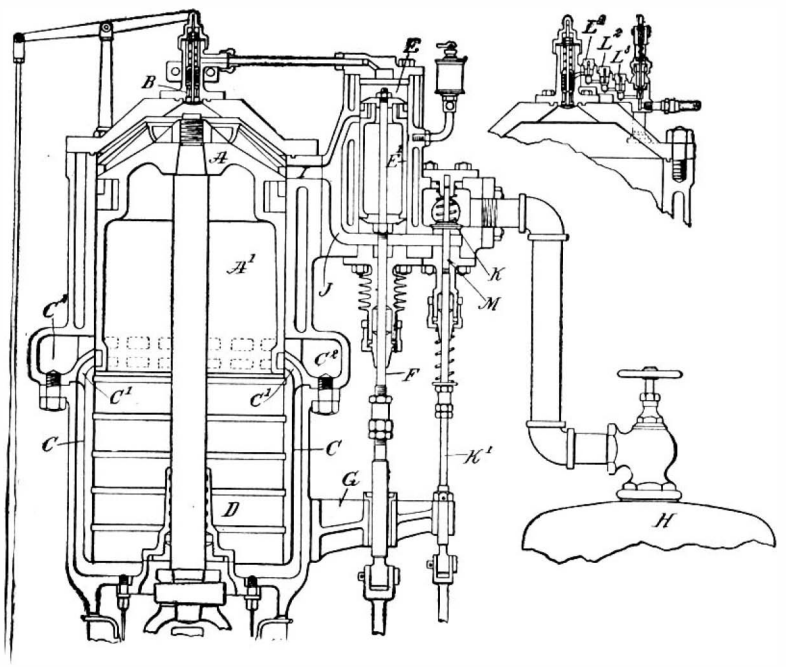
THE OSTERGREN FUEL OIL ENGINE.

Mr. Oscar P. Ostergren, well known to the readers of this journal as the inventor of a successful process of liquefying air, and as a mechanical engineer who has made some notable improvements in steam engine design, now comes forth with an invention in which he claims to have solved the problem of utilizing kerosene, heavy oil, or crude oil in an engine without any danger, without the attendant objectionable odors and deposits, and with but a tithe of the operative cost of present types of internal combustion engines. The invention in question, so far from being an untried mechanical device, has been successfully introduced by the Fuel Oil Power Company, 50 Wall Street, New York. There are in progress of construction a 25 horse power reversible marine engine and also a 30 horse power four-cylinder reversible self-starting automobile engine, the designs of which at present are not for publication. The accompanying illustrations, however, represent a 50 horse power stationary engine in perspective and in section. In order that a statement of the general merits of the invention may be appreciated at its true worth, some explanation of the operation becomes necessary.

Broadly considered, the apparatus comprises three elements—the engine itself, a pressure device for feeding oil to the engine, and a compressed air reservoir for starting the engine automatically. The engine pictured is of the single-cylinder, two-cycle type. Its hollowed trunk-piston A is finished off with a conical cap conforming in shape with the cylinder-head, on which a spring-pressed poppet valve B is mounted for the injection of the oil. As the piston A of the engine moves down, the air within its hollowed or recessed portion A^1 is compressed, driven into the air-jacket C, then through the annular port C^1, and into the cylinder. The blast of air thus forced into the cylinder discharges the previously burnt gases through the annular port C^2, and leaves in their stead fresh, pure air, which, after compression, and simultaneous elevation of temperature, is ready to receive the fuel at the proper period. The evacuated gases are not discharged into the atmosphere directly, but are allowed to flow from the annular conduit surrounding the exhaust port into a fuel preheater in which a worm-shaped fuel conduit is contained.

On its upstroke the piston A closes both ports C^1 and C^2. The suction valve D is now opened, whereby air is admitted into the cylinder. The valve is kept open during the upstroke, but the pressure in the cylinder of the air thus admitted is such that on the downstroke of the engine it does not register more than seven pounds above the atmospheric pressure. By the proper adjustment of the suction valve parts considerable latitude in the amount of this pressure can be obtained in order to vary the rapidity of the discharge of the burnt gases.

As the piston continues on its upstroke, a part of the air is driven through the duct I into the compression chamber E of the auxiliary pressure device, and thence into the chamber of the valve B. When the piston has completed about three-fourths of its upstroke, a cam on the engine-shaft L will move the rod F so as to close the inlet from the main cylinder. Both pistons A and E^1 have up to this point been moved at such a rate that the pressure in the chamber of the poppet valve B and the pressure in the main cylinder are equal. Such is the shape of the cam on the engine shaft that the rod F and piston E^1 will move very rapidly while the motion of piston A is retarding toward upper dead center. This condition, assisted by means of the large difference in proportion of final clearance volumes in the two compressors, soon causes the pressure in the chamber E and the poppet-valve chamber to exceed that in the main cylinder. Consequently when the piston A has completed its upstroke and the piston E^1 is about half way up, the pressure in the poppet-valve chamber is such that the valve B is opened. The charge of oil contained within the valve chamber is now forced into the main cylinder head, under the constantly increasing pressure of the piston E^1 as it completes its upstroke. Combustion now takes place continually until the charge is consumed. Such is the shape of the cam controlling the movements of the piston rod F, that the piston E^1 does not complete its upstroke until the engine-piston A has finished one-quarter of its downstroke. During this interval, fuel is forced into the combustion-chamber



SECTION OF A SINGLE-CYLINDER OSTERGREN FUEL-OIL ENGINE.

and is cut off only when the increasing pressure therein closes the valve B. When the piston A has completed the second quarter of its downstroke, the piston E^1 will still be held up by its cam. Part of the gases escape through the duct J, passing the valve K, into the compressed-air reservoir H, but only when the pressure in the reservoir is less than that of the gases and the spring K.

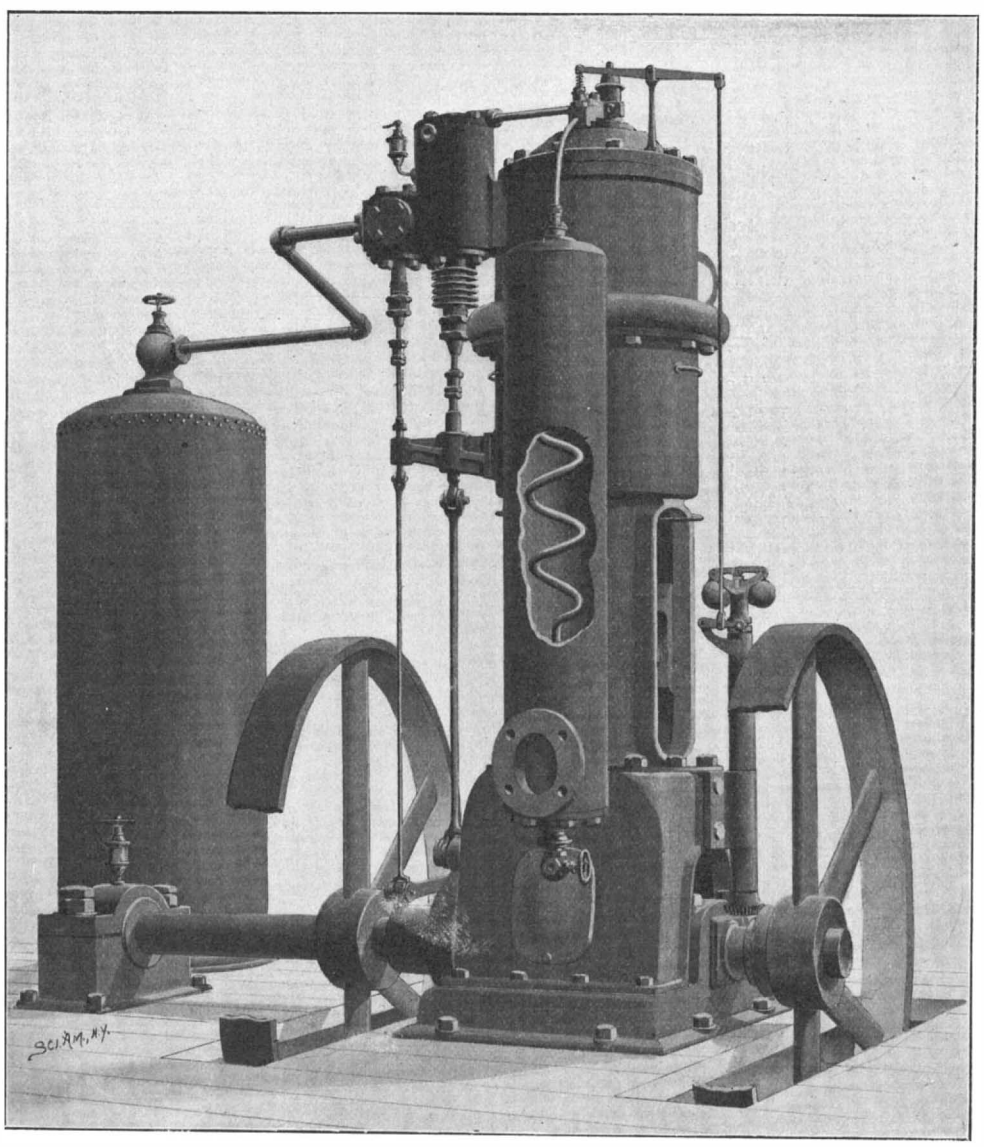
Not until the last quarter of the downstroke does the piston E^1 begin to drop. When the engine-piston A has completed its downstroke, the auxiliary piston has returned to its initial position, that is, the position shown in our sectional view. As it falls, the piston E sucks a charge of oil into the poppet-valve chamber B. The oil is fed by gravity or by pressure from a tank into the worm of the previously mentioned pre-heater, and raised to about the height of the three check valves, L^1, L^2, L^3, by which the oil is prevented from flowing back under the pressure of the upstroke of the piston A. A valve in the pipe leading from the pre-heater coil is connected with the centrifugal governor of the engine, so that the feeding of the fuel is controlled in accordance with the requirements of speed and load at any particular moment.

The pressure within the compressed-air reservoir H is such that the main piston in one of the cylinders of a two-cylinder engine is easily driven down; and the piston in the other cylinder raised in order to produce a sufficient compression to insure ignition even with cold fuel oil. With a single cylinder, the air from the reservoir drives the piston down, the momentum of the flywheel forcing the piston up again in order to obtain sufficient compression. If the engine shaft be cranked and a relief cock at the top of the cylinder left open until the air from the reservoir is allowed to enter, the starting of the engine is facilitated. Starting is thus effected by lifting the valve K by a cam on which the foot of the rod K^1 rests.

The compressed air of the reservoir cannot be admitted to the cylinder through the ducts J and I when the piston is at dead center, because at that moment the outlet duct I is closed. Not until the piston is carried past the dead center can air be allowed to enter.

Summing up the meritorious features of this engine, it becomes apparent that the quick though gradual combustion of the fuel renders it possible to subject the cylinder charge to great pressure. As soon as the engine has been started by electric spark, the ignition is effected by reason of the high compression in connection with the raised temperature of the atomized oil. By flushing the cylinder with atmospheric air before injecting the fuel, the well-known impediments of the two-cycle system, chiefly waste of fuel in scavenging and premature ignition are avoided.

An impulse at every downstroke of the piston is obtained, thereby increasing the power development and efficiency even above the considerable increase obtained by high compression alone. The peculiar conical shape of the piston and the cylinder head increases the capacity for heat absorption and radiation, and renders it possible to divide the space containing the charge into a central portion favorable for immediate ignition. From this central portion compartments ramify into which the flame can enter only as the mixing of the vapor and atmospheric air progresses. The oil, spread in a fine mist, is consumed because of ignition by compression, without harmful consequences if it should be too liberally supplied. The ignition does not start in any one particular spot, as when an electrical spark is employed, but at any point within the combustion-chamber where the conditions are most favorable.



OSTERGREN 50 HORSE POWER FUEL-OIL ENGINE.

A "Mob" Cartridge for Use in Strikes.

The many strikes of late years have led army officers to direct their inventive skill to the devising of a bullet that will be not more deadly to armed mobs, but much less dangerous than the one now in use. A bullet from the present rifle will pierce 18 inches of pine at 500 yards; the human body has only a resistance of 3 inches of this wood. The Ordnance Department has therefore devised what is now popularly called the "mob cartridge," but which the Department euphemistically terms "multi-ball cartridge, caliber 30."

The cartridge is composed of a service case charged with a full charge, about 34 grains of smokeless powder, and two round balls held in the neck of the case by a cannulure at the lower end and a crimp at the upper. The balls are made of a mixture of lead and tin in the proportion of 16 to 1, and are slightly coated with paraffine. The diameter of the ball is 0.308 inch, and the weight is 42 grains. The cartridges have sufficient accuracy for effective use at 200 yards, at which range a slight elevation is required. At one hundred yards it is necessary to fire point blank.

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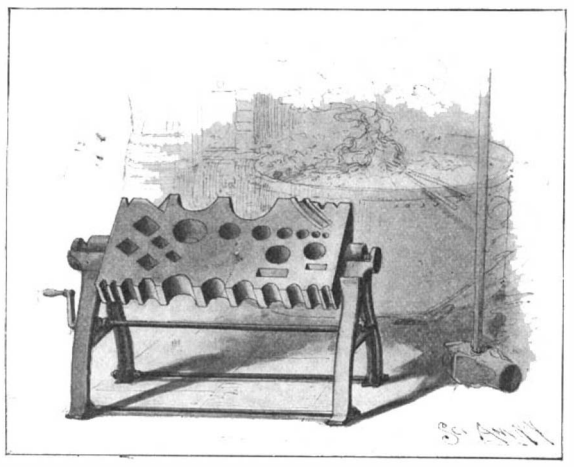
AN IMPROVED TYPE OF SWAGE BLOCK.

We show in the accompanying engraving an improved type of swage block invented by Mr. Horace B. Blood, of 89 Webster Avenue, Rochester, N. Y. For the benefit of those of our readers who are not acquainted with the term, we would define a "swage block" as a heavy iron block or anvil provided with notches and perforations which may be used by blacksmiths in shaping metal. The swage block illustrated



AN IMPROVED TYPE OF SWAGE BLOCK.

is so arranged that it may be readily clamped in any desired position and may as readily be released whenever it is necessary to adjust the anvil to a different position. The block it will be observed has trunnions or journals which engage open bearings formed on the top of the standards of the frame. The standards are connected with each other at their lower ends by bolts. Midway of their height they are connected by a clamping device which consists of a rod revolubly secured to one standard and threaded into a nut in the other standard. By operating a crank on this rod the upper ends of the standards may be drawn together to bind against the ends of the swage block and hold it from turning. Inwardly-directed flanges are formed on the standards just below the trunnion bearings, and these on being drawn inward form firm supports for the swage block when in horizontal position. The recesses lying between these flanges receive and securely hold the swage block when turned to vertical position. When the swage block is held at other angles the flanges sink into grooves formed in the ends of the block around the journals. The usual variety of notches, recesses, perforations, etc., are provided for assisting in upsetting bolts, shaping horseshoes, and forming all other devices which a blacksmith may be called upon to make. The construction of this swage-block is the extreme of simplicity, and the operator will find the tool useful because it may be so easily released from one angle, so readily adjusted to any other angle, and then so quickly and firmly clamped in the required position.

A METHOD OF MAKING GLASS MODELS OF MINES.

The Hill-Chamberlin Manufacturing Company, of New York city, has a patented method of making glass models of mines which enables them to reproduce in solid glass to an accurate scale all the underground workings and surface features of gold, silver, copper, iron, or coal mines.

The models are constructed of thick sheets of clear white glass, laid one upon another, and bolted together, thus forming a unit. The underground workings of the mine are excavated from the glass, and all drifts, shafts, stopes, winzes, upraises, crosscuts, etc., are shown as miniature excavations exactly as they exist in the mine. The top of the model, representing the surface of the ground above the mine, is cut to accurately represent the topographical features of the surface. Future workings can be added to the model as the development of the mine progresses.

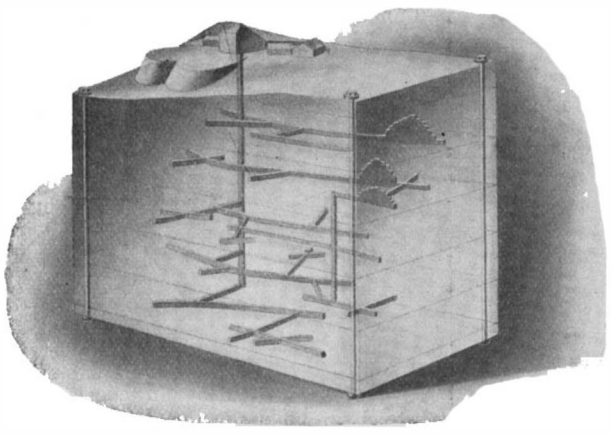
The sheets or plates of glass are fastened together by small bolts, one in each corner serving for the purpose; the holes for the same being drilled perfectly true and of uniform diameter, great care being taken to prevent even the smallest chips at the edges. The holes are drilled with such precision that no extra clearance is left between the bolts and the sides.

After the plates are securely bolted together, the edges are ground to a uniform plane on a horizontal iron disk charged with sand, and are then smoothed and polished. The top plates, intended to represent the topographical features of the surface, are ground upon upright iron mills and stones of various shapes and sizes, and are afterward brought to the same high polish as the sides.

The underground workings of the mine are excavated from the glass by small steel disks and drills of various shapes and sizes, charged with carborundum; the greatest care being necessary to prevent tool marks and small chips appearing in the cuttings. Stopes and other workings between the levels can thus be shown either vertical or on the dip of the vein. Shafts and winzes are shown in the model as rectangular openings with smooth sides. Veins and fissures are shown extending downward from the surface, and on their proper dip and trend across the property, by use of a sawing machine capable of cutting through glass of great thickness; being constructed as an endless band charged with carborundum and running at great speed.

An excellent representation of ore in place in the vein is accomplished by filling the saw cutting with a semi-transparent colored substance mottled to show the structure of the vein.

In assembling the various plates the horizontal planes are coated with a transparent substance adjusted to the same refractive index as the glass, thereby making the entire model optically homogeneous and avoiding the annoying reflections caused by a series of horizontal polished planes.

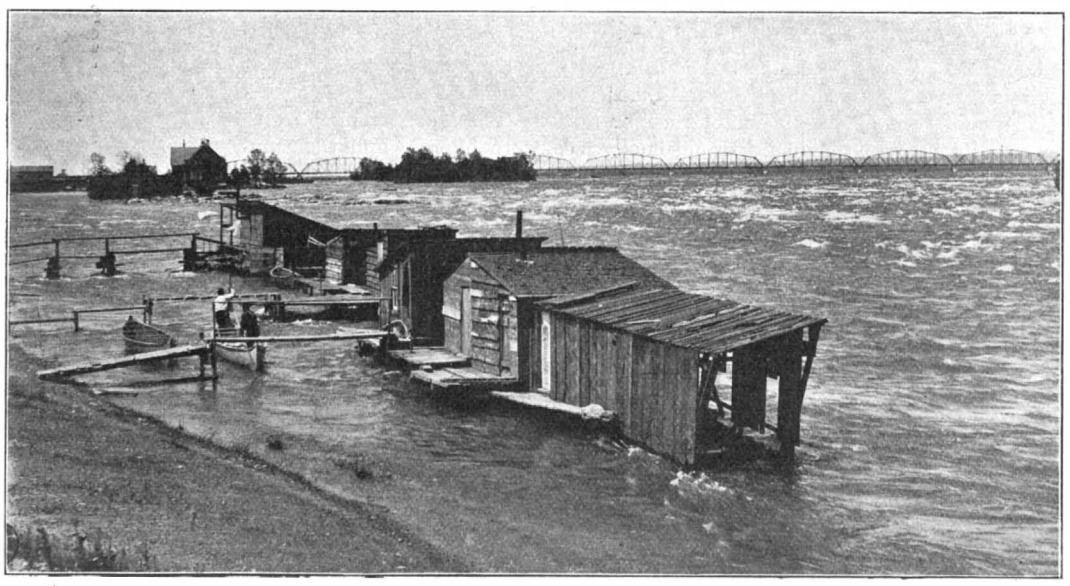


A GLASS MODEL OF A MINE SHOWING UNDERGROUND WORKINGS.

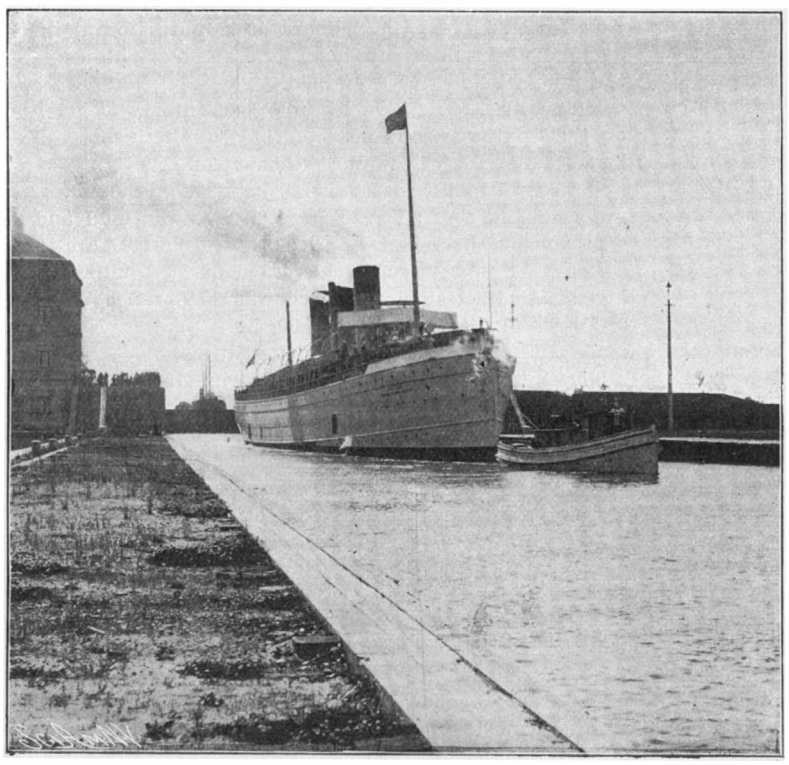
THE "SOO" SHIP CANAL SYSTEM—THE FIFTIETH ANNIVERSARY OF ITS COMMENCEMENT.

BY DAY ALLEN WILLEY.

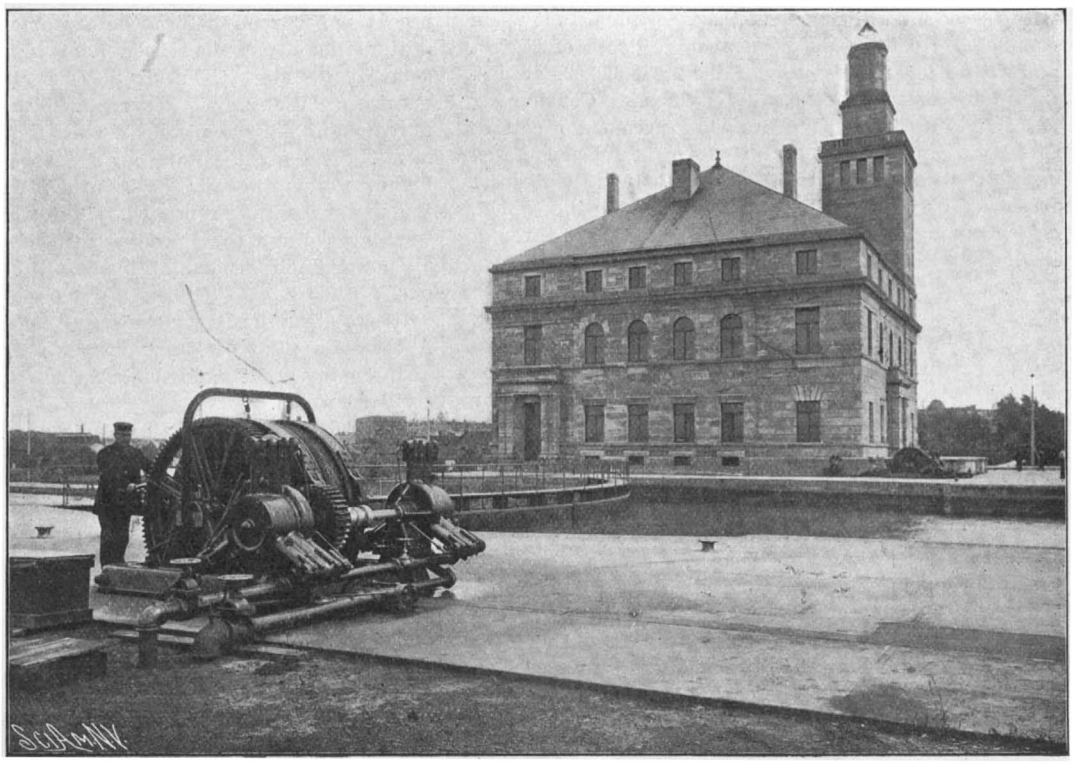
This month marks the fiftieth anniversary of the digging of the Sault Ste. Marie Canal system. On June 4 a celebration, international in its character, commemorated the work begun a half century ago. Representatives of the United States and Canadian governments, in addition to prominent officials of Michigan and other States bordering on the Great Lakes, participated. Their presence was appropriate; for the importance of the canals both to this country and the Dominion is indicated by the traffic which passes through them. Since the gates of the canal locks were first opened, the commerce of the upper lakes has developed to such an extent that during the past year nearly 36,000,000 tons of freight passed into Lakes Huron and Superior. This is an increase of 7,500,000 tons over any previous year in the history of the canals, and, as is well known, is far greater than that of any other artificial waterway in the world. In fact, the "Soo" has been contrasted with such passages as the Suez, which, furnishing a short route between two continents, is perhaps the next in commercial importance. This canal, although it cost $140,000,000 in round numbers, represents an average yearly traffic of less than 10,000,000



THE RAPIDS OF SAULT STE. MARIE.



S. S. "NORTHLAND" AT SAULT STE. MARIE.



GATE-OPERATING MECHANISM AT SAULT STE. MARIE.

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tons, so that the business done by the "Soo" is more than three times as great.

The history of the American enterprise is of interest, since it may be called the pioneer engineering work of the Northwest. In 1852 Congress made a land grant of 750,000 acres to the State of Michigan, which enabled the commonwealth to begin work. Excavation was begun on June 4, 1853, and, considering the crude facilities for construction, the canal was completed in a remarkably short period, being opened in June, 1855. The Canadian system or the St. Mary's Falls Canal parallels the north shore of St. Mary's River. It is but 1 1-3 miles in length, and is a comparatively new project, having been completed less than a decade ago. With the completion of these systems began a new era in lake commerce. As the vast natural resources of the country tributary to Lake Superior were afforded an outlet to market by this means, the number of vessels passing through the American canal increased to such an extent that the necessity of enlarging the waterway was made imperative. The passage was widened and deepened to such an extent that it was practically rebuilt. With the greater depth of water, vessel builders on the lakes availed themselves of the opportunity to construct larger craft. It may be said that marine architecture has developed in proportion to the improvements made. Then came the development of the great ore beds in the Mesabi range and vicinity, from which about 220,000,000 tons have thus far been taken. This was a most important factor in further expanding the commerce of the upper lakes passing through the canals, until in 1895 no less than 17,956 vessels were locked through, carrying 16,807,000 tons of freight. It is to be noted, however, that in less than ten years the traffic has more than doubled. This is why the further enlargement of the Michigan canal is under consideration, and it is not unlikely that the government will decide upon plans to be carried out within the next few years. As it is, the famous Poe lock was not opened to navigation until 1896, but in spite of its great capacity blockades are quite frequent.

A comparison with other notable waterways in addition to the Suez gives a clearer idea of the importance of the American Sault. While one of the shortest of canals (its length is only three miles), from 75 to 125 steamships, barges and other craft pass through it every 24 hours, despite of the fact that lake carriers have been so greatly enlarged. The Suez, including the lakes which form a portion of its channel, is 100 miles long, and its tolls annually amount to about $15,000,000. The Kaiser-Wilhelm Canal, which is 61 1-3 miles in length, cost $40,000,000, yet its annual traffic represents only about 2,500,000 tons, while its yearly receipts range from $275,000 to $300,000. The Manchester Canal, which has given the city of this name in Great Britain the advantages of a seaport, is 35½ miles in length and cost in round numbers $75,000,000 including its wharf system. The freight tonnage passing through it annually has increased to about 2,500,000, while its tolls aggregate between $1,000,000 and $1,250,000. Next to the Sault, its locks are among the most extensive in the world, being 600 feet in length. Of the smaller European canals, the North Sea is probably the most important, being 16 miles in length and having a traffic of about 5,000,000 tons of freight yearly. Its cost was $40,000,000. The Elbe and Trave Canal in northern Europe is 41 miles in length, but navigable only by small vessels, as it is but 10 feet in depth. The Cronstadt in Russia, 16 miles in length, has a depth of 20½ feet and cost $10,000,000, the former costing $6,000,000. The waterway which will connect Berlin with the ocean will be one of the most important when completed, as it will have an average depth of 25 feet and will represent an outlay of about $50,000,000 according to the calculations of the engineers. Considering the difficulties involved in its construction, the cost of the Sault canal in its enlarged form is not considered excessive, being less than $10,000,000. It is the deepest fresh-water canal, with one exception, in the world, craft drawing 18 feet of water being able to go through its locks without difficulty.

As already stated, the building of the Sault Canal has proved a stimulus to the development of shipbuilding on the lakes, allowing ore barges and steamships capable of carrying as high as 7,500 tons of cargo to be constructed for the service between the Lake Superior deposits and the receiving ports on Lake Erie. It also led to the building of the Northern Steamship Company's fleet of vessels for passengers exclusively, which are notable for their proportions. Incidentally, it might be added that yearly 60,000 passengers go through the Canadian and American canals. In addition to iron ore, lumber and grain constitute a large proportion of the tonnage, although the bulk of the 27,000,000 tons mined in the Mesabi region and vicinity during 1902 was shipped to the smelters by vessel. In fact, the construction of the canals has led to considerable railroad building in Pennsylvania. It is perhaps unnecessary to refer to the Pittsburg, Bessemer & Lake Erie, completed principally to carry this ore from its lake terminus at Conneaut to the Pittsburg district, representing 233 miles of track and a cost of $10,000,000.

One factor which aided in the construction of the American canal was the comparatively small difference between the level of Lake Superior and that of Lake Huron—20 feet; but it contains the most capacious lock of any waterway in the world—the famous Poe lock, named after the engineer who planned it. This is 800 feet in length, 100 feet in width, and 21 feet in depth. The entire length of its side walls is 1,100 feet, ranging in thickness from 20 feet at the bottom to 10 at the top. The flow of water is controlled by five gates of steel, the upper ones having a height of 26½ feet, the intermediate 43, and the lower 25 feet. Each leaf of the smaller gates weighs 100 tons, the larger representing 190 tons. Two plants are utilized, that for operation being entirely independent of the pumping machinery. The latter consists of twelve engines, of which three are of 350 horse power each, which are held in reserve for emptying the lock in case of accident. They are connected with three 30-inch centrifugal pumps, and it is an actual fact that the lock chamber can be filled and emptied in seven minutes. It is filled by means of lateral sluices. This lock represents more than half of the cost of the canal, as the total outlay for it was $5,000,000. The other lock on the American waterway is but 500 feet in length and 80 feet in width. This is termed the Weitzel, and with its companion furnishes the necessary canal levels.

Reference might be made to the somewhat curious combination of power and ship canals in this locality. Not only are vessels afforded passageways on the American and Canadian sides of the river, but, as is well known, two of the most extensive power canals in the world have been constructed as well, both by the same company. The American canal represents a cost of about $4,000,000, being two miles in length, 30 feet in depth, and having the remarkable width of 200 feet. It supplies power for a series of 320 turbine waterwheels, and is calculated to develop at least 57,000 horse power for generating electrical current and other purposes.

Motor Racing and Motor Records—A Retrospect.

BY OUR LONDON CORRESPONDENT.

In view of the very great interest that is being aroused in the forthcoming race for the Gordon Bennett Cup in the United States, France, Germany, and England, a few notes on the past history of motor-car racing may not be unacceptable. In 1890 Gottlieb Daimler introduced the petrol gas-motor, and in 1894 M. Pierre Giffard, an editor of the Petit Journal, organized a motor race, or rather a trial race, from Paris to Rouen. Handsome prizes were offered, and the competitors started, some using steam, others petrol cars. The winning car (a Panhard-Levassor with a 3½ horse power Daimler engine) reached a trial speed of 13 miles an hour.

In 1895 a race from Paris to Bordeaux and back again to Paris took place. M. Serpollet, who in 1889 had produced a steam-driven tricycle fitted with his own type of boiler; Comte de Bion and M. Bollée entered steam-cars. An electric car, the Jeantaud, also took part, but the petrol cars proved their superiority and carried off the prizes, which amounted to £2,500.

The winner was Mr. Levassor, who drove a 3.5 horse power carriage (driven by a Daimler motor) weighing about 12 hundredweight. The total distance was 732 miles, and this was accomplished in just under 48 hours 47 minutes, or at an average speed of nearly 15 miles an hour.

"Prior to this race," said M. Charles Jarrott in a recent paper read before the Automobile Club, "several racing events had been held which had aroused some little interest, but it was not until this really great race that any of us realized the future of the automobile. As a physical feat it was marvelous. . . . The great point, however, which was forced home on our mind was the fact that the possibilities of the motor had been proved. Both the distance that was covered and the average speed of nearly 15 miles an hour which was maintained, seemed to us marvelous."

It was after the Paris-Bordeaux race of 1895 that the Automobile Club of France was formed, the pioneer of the many great motor clubs to be found all over the civilized world.

In 1896 a Paris-Marseilles-Paris race, a distance of 1,061 miles, was organized by the new club. It was won by M. Majade on the first four-cylinder, four horse power Panhard-Levassor car built by the now world-famous firm, in 67 hours 43 minutes, at an average speed of over 16 miles an hour. Of twenty-two starters, only nine finished, as the weather was very unfavorable.

The second car—a Panhard—was driven by the Chevalier René de Knyff—one of the most famous of modern chauffeurs—who can boast the proud distinction of having attained the fastest speed on a car during a contest.

At one stage of the Paris-Vienna race the chevalier was timed to be traveling on a down grade at no less than 98 miles an hour. The third car—also a Panhard—was driven by Mr. Levassor, who experienced a very bad smash-up in trying to avoid a dog and died shortly afterward. His mechanic, however, drove it into third place. Among other competing cars were some made by Delahaye, Peugeot and De Dion-Bouton.

In the Paris-Bordeaux race of 1897 the Chevalier de Knyff came off victor. The distance (573 kilometers = 356 miles) was done in 15 hours, an average of 38 kilometers (24 miles) per hour. In the Paris-Dieppe and Paris-Trouville races of this year an average of 26 miles an hour was maintained.

In July, 1898, the Paris-Amsterdam race, the first of the big inter-country races organized by the Paris Automobile Club, took place. The winner was M. Charron, who did the 152 kilometers on an 8 horse power Panhard in 33 hours 4 minutes—or at an average of 27 miles an hour. In this contest some of the four-cylinder, 8 horse power Panhard cars were seen for the first time.

The two big events of 1899 were the Paris-Bordeaux race and the "Tour de France." The former—351 miles—was won by M. Charron on a 12 horse power Panhard, who came out with an average of 34 miles an hour, the distance being accomplished in 11 hours 43 minutes without a stop. In the Tour de France, the longest motor race ever held, the Chevalier de Knyff, on a 16 horse power Panhard, did the 1,440 miles in 43 hours 33 minutes.

Other races of 1899 were the Paris-St. Malo (200 miles), won by M. Antony on a 16 horse power Mors in 7 hours 32 minutes; the Paris-Ostend (204 miles), in which M. Giradot on a Panhard and M. Levegh on a Mors tied for first place; Paris-Boulogne (143 miles), won by M. Giradot on a Panhard, and the Bordeaux-Biarritz, won by M. Levegh on a 16 horse power Mors.

In June, 1900, came the first Gordon Bennett race. In 1899 Mr. James Gordon Bennett presented the Automobile Club de France with a work of art to be raced for by motor cars and to be held as an international trophy. It is generally known as the "Gordon Bennett Cup," but it is in reality no cup, but a piece of plate in the form of a model of a motor car carrying two figures, "in anything but motor-car costume," as some one has remarked. The "cup" is now to be seen in the drawing-room of the club house of the Automobile Club in Piccadilly.

The rules for the cup include the following: Any recognized club may enter three cars to represent its own country; every car competing must have been constructed *entirely* in the country it represents; the race must be held in the country holding the cup, or failing that, in France.

The first Gordon Bennett race was from Paris to Lyons, a distance of 556 kilometers. It was won by M. Charron, who drove a Panhard-Levassor car; his average worked out at 61 kilometers.

In July, 1900, a Paris-Toulouse-Paris contest took place. The winner was M. Levegh on a 24 horse power Mors, who covered the distance of 836 miles in 26 hours 43 minutes, or at an average of 42.7 miles an hour.

It was in this race that the really big racing car made its appearance for the first time. The 24 horse power Mors beat the Panhard cars, and the fierce rivalry between the two great firms then had its origin. In the Paris-Bayonne race De Knyff attained a mean speed of 43.4 miles an hour; the distance being 208 miles. He drove a 20 horse power Panhard, and during one part of the race he is said to have done 34½ miles in 33½ minutes. The other interesting races of 1900 were the Bordeaux-Perigueux (252 kilometers), won by M. Levegh in 2 hours 40 minutes, or at an average of 51 miles an hour, and the Paris-Rouen—the first alcohol race ever held.

Motor-car racing now became exceedingly popular on the Continent, and space forbids anything but the briefest mention of the most famous contests.

On May 29, 1901, the Paris-Bordeaux race (328 miles, not counting the neutralized sections), was held and was won by M. Fournier on a 60 horse power Mors in 6 hours 11 minutes, at an average of 53¾ miles an hour. His fastest timed piece was 17½ miles in 15 minutes. In this race the 50 horse power Napier made its appearance for the first time.

The Gordon Bennett cup race was run simultaneously over the same course. The only three competitors were all Frenchmen, viz., MM. Charron, Levegh and Giradot. Only the last-named finished.

In June, 1901, came the Paris-Berlin race, when M. Fournier again proved victorious, covering 686 miles in 16 hours 33 minutes, or at a mean velocity of over 44 miles per hour, excluding 63 miles of "controlled" district, through which each competitor had to follow a cyclist at 6 or 8 miles an hour in order to insure the safety of the public and effectually prevent an attempt at racing through crowded places.

The Paris-Vienna and the Gordon Bennett cup races were the most important racing fixtures of 1902. The latter was run over part of the same course (Paris-Innsbrück, 379 miles) as the former, and at the same time. It was won by Mr. S. F. Edge, A. C. G. B. I., the

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only English representative; France—the only other nation represented— entered three chauffeurs.

"Personally, I shall never forget," writes Mr. Jarrott, "my elation when I saw the great hope of France —Fournier—out of the race on the first day, Giradot having already finished his effort soon after the start, leaving De Knyff the sole champion for France. With Edge in slight trouble, but still going well, England's hopes at the end of the first day were much brighter than at the beginning."

The Paris-Vienna contest was won by M. Marcel Renault on a 16 horse power voiturette. The distance was 615 miles (after deducting the Swiss or neutralized portion of the route), and it was done in 15 hours 47 minutes 43 seconds, or at 40 miles an hour. It is noteworthy that 75 per cent of the starters arrived at Vienna. M. Henri Farmar was second (16 hours 0 minutes 30 seconds), M. Edmond was third (16 hours 10 minutes 16 seconds), and Count Zborowski was fourth (16 hours 13 minutes 29 seconds).

The other most important contests of 1902 were the Circuit du Nord Alcohol race, 571½ miles (865 kilometers), won by M. Farmar on a 40 horse power Panhard in 11 hours 55 minutes, or at an average of 47.69 miles an hour, and the Circuit des Ardennes (318 miles, 512 kilometers), won by Mr. Charles Jarrott in 5 hours 53 minutes 39 seconds, giving an average speed of 54 miles an hour. M. Gabriel was second, and Mr. W. K. Vanderbilt, Jr., third.

The superiority of the petrol car over the steam or electric for racing purposes has been abundantly proved. According to the Hon. C. S. Rolls, steam cars have only gained first place on two occasions, viz., the "Concours du Petit Journal" in 1894, and the Marseilles-Nice-Turbie race in January, 1897, when a De Dion brake covered the rough and hilly route of 145 miles in 7¾ hours.

MOTOR-CAR RECORDS IN LONG DISTANCE RACING.

Year.	Course.	Mean Speed of Winning Car.	H. P. of Winning Car.
		Miles an hour.	
July, 1894	Paris-Rouen (128 km.)	13	3½
June 11, 1895	Paris-Bordeaux-Paris (1,200 km.) (Winner M. Levassor)	15	3.5
Sept. 24, 1896	Paris-Marseilles-Paris (1,760 km.) (Winner M. Mayade.)	16	4
1897	Paris-Bordeaux (Winner Chevalier Rene de Knyff.)	24	..
July 24, 1897	Paris-Dieppe (170 km.)	25	3
July 7, 1898	Paris-Amsterdam-Paris (1520 km.) (Winner M. Charron)	27	8
May 24, 1899	Paris-Bordeaux (565 km.) (Winner M. Charron)	34	12
July 16, 1899	Tour de France (2,219 km.) (Winner Chevalier R. de Knyff.)	29	16
July, 1900	Paris-Toulouse-Paris (Winner M. Levegh)	42	24
May 29, 1901	Paris Bordeaux (527 km.) (Winner M. Fournier)	53¾	60
June 27-30 1901	Paris-Berlin (1,198 km.) (Winner M. Fournier)	44	28
1902	Paris-Vienna (Winner M. Renault)	40	16

THE GORDON BENNETT CUP.

Year.	Course.	Winner.
June, 1900	Paris-Lyons	M. Charron on a Panhard-Levassor
1901	Paris-Bordeaux	M. Giradot on a Panhard
1902	Paris-Innsbruck	Mr. F. S. Edge on a Napier

A Remarkable Surgical Operation by Which Sight Was Restored to a Congenitally Blind Man.

Readers of the SCIENTIFIC AMERICAN have doubtless noticed in the daily press brief accounts of the remarkable case of a man whose sight has been restored after thirty years of blindness. In the current number of the Lancet, Dr. A. Maitland Ramsay, the surgeon by whose skill the unfortunate was enabled to see the world which had been shrouded in blackness to him since his birth, publishes a very complete account of the case.

The patient, aged thirty years, blind from birth, was brought to the Glasgow Ophthalmic Institution on February 24, 1903. He had been allowed to run about as he pleased, no attempt to educate him having ever been made. He became, however, so familiar with the country district (a few miles from Glasgow) in which he resided that he could go about without the slightest fear; and his hearing was so acute that he knew at once if there was anything unusual on a road along which he was walking, and thus he never had any difficulty in keeping himself out of danger. As he passed along a road he could tell a wall from a hedge by the sound of the air coming through the leaves and branches of the latter. He could easily go on an errand to any house in his native village, for the resonance of his footfall—quite different in sound when he was passing a building from what it was when he was opposite an open space—enabled him, perfectly familiar as he was with his surroundings, to count the houses as he passed, and thus to turn corners and finally to stop at the one which he wanted. He distinguished different blossoms partly by touch but chiefly by smell, and by dint of asking questions he got at last to know so much about their form and color that he could arrange them in a bouquet. Occasionally he worked in the harvest field and he could bind the corn and arrange the stooks as well as any of the other laborers.

The patient was quite unable to distinguish objects, although he could tell day from night and could easily perceive a light and locate it accurately; he seemed to have had no perception of bright colors.

As a cataract seemed to be the only obstacle to vision Dr. Ramsay resolved to operate and extracted the lens from the right eye on March 11, and that from the left eye a week later. Both lenses were small and shriveled and the nucleus of the right was calcareous. For about ten days after the operation on the left eye the patient appeared to be quite dazed and could not realize that he was seeing. The first thing he actually perceived was the face of the house surgeon. He said that at first he did not know what it was that he saw, but that when Dr. Stewart asked him to look down, the sense of hearing guided his eye straight to the point whence the sound came, and then, recalling what he knew from having felt his own face, he realized that this must be a mouth, and that he must be looking at a face. Once he properly understood what vision meant he made very rapid progress and his extraordinarily retentive memory enabled him to take full advantage of everything that he was told. He was quite ignorant of color, but learned to distinguish hues very quickly. The first tint that he saw was red. A red blanket lay across the foot of his bed. He asked what it was and was told, and never afterward did he have the slightest hesitation in discriminating red again. He was shown a narcissus, and on being asked to describe it he immediately recognized the flower and knew from his old bouquet-making experience that it was white and yellow, but he now for the first time also became aware of the little red band in the center and at once called attention to it. When he was shown a bunch of daffodils he recognized them by their smell and immediately said that they must be yellow. The color that took him longest to master was green, but he can now name all ordinary tints readily and correctly. His difficulty with green is hard to explain unless it be that with green he has no smell-association such as he had with colored flowers. Unlike Locke's blind man, who imagined that "scarlet was like the sound of a trumpet," he does not seem to connect any distinct ideas with particular colors except that he said that red gave him a feeling of pleasure and that the first time he saw yellow he became so sick that he thought he would vomit. The latter feeling, however, has never recurred.

He rapidly learned the letters of the alphabet and figures and he will soon be able to read and to reckon. From the very first he saw everything in its actual position, showing that the retinal inversion of a picture is interpreted psychically without any education.

He could count accurately after he had looked at objects one by one and seemed to derive much help in his calculations by pointing with his finger. Here again he seemed to translate touch into vision and to arrive at a perception of the whole through the perception of the individual parts. He cannot take things in at a glance. He does not see the passers-by on the opposite side of the street quickly. He looks most intently and moves his head backward and forward and from side to side as if trying to get a view of them all round before he can make up his mind what he is seeing; in a room, however, he can distinguish things much more quickly. With any complex outline, however, or group of outlines, he still has considerable difficulty, though pictures are no longer to him, as they were at first, mere masses of confused color.

He was able to estimate size and distance more readily that might have been anticipated, although he said that he felt that if he were out of doors by himself he would be "wandered." From the time he got out of bed after the operation he could guide himself with ease through a doorway and walk about on the level, but he had considerable difficulty in ascending a stair, because the steps seemed so high that to begin with he raised his foot much farther than was necessary and without meaning to do so went up two steps at a time. Whenever he discovered his mistake he began to pay attention to the rise of each and he has now no difficulty in estimating their height. This, of course, was part of his difficulty in judging distance, though when he first looked out of a window on to the street and saw the pavement below he said that he felt that if he had a stick he should be able to touch it. Before the operation he could guide himself fearlessly through a ward without coming in contact with the beds or any other obstacle that might be in the way, but since he has been able to see he says that he has lost all that feeling of confidence and when his eyes are shut he is afraid to move and is impelled to open them to ascertain where he is going—so much so that he does not know what he would do if he again became blind.

When he is requested to look in any particular direction he is unable to cause the ocular muscles to do what he wishes, and the balls oscillate and one or other turns inward to such an extent that a portion of the cornea is hidden by the inner canthus. This want of control renders it very difficult to make a satisfactory ophthalmoscopic examination, but as far as can be made out the fundus oculi is normal; indeed, the functional activity of the optic nerve since the cataracts were removed is very remarkable and is in striking contrast to the purposeless muscular movements. Disuse has crippled the function of the latter, but seems to have had but little effect on the activity of the former. The eye is a receptive organ and the light that gained access to the retina through the opaque lens proved stimulus sufficient to maintain the optic nerve in health, while the want of visual power deprived the co-ordinating center in the brain of all stimulus to develop and hence the ocular muscles are not trained to obey the dictates of the will.

New Motor Cycle Records.

On the Empire City track new records were made for motor cycles on May 27, 1903. B. Oldfield made a three-mile trial with the following result: One mile, 1 minute 6¾ seconds; two miles, 2 minutes 12 seconds; three miles, 3 minutes 19 seconds. The second mile was made in 1 minute 5¼ seconds. The record for the track was 1 minute 6 4-5 seconds, made by Fournier on October 9, 1901.

Albert Champion made a five-mile trial with his four-cylinder motor cycle. His times were: One minute 14 seconds, 2 minutes 24 seconds, 3 minutes 57 seconds, 5 minutes 9 seconds, 6 minutes 16½ seconds. Then he went for a mile with a flying start. He made the half in 35½ seconds and the mile in 1 minute 6½ seconds.

This time for the mile is lower than the new record established by Fred Chase, the English motor cyclist. Chase made the mile with a flying start in 1 minute 6 3-5 seconds at Canning Town. The previous American record was 1 minute 10 2-5 seconds, made on the Vailsburg track by Champion last year. The timing was done by three competent horsemen, but the figures cannot be accepted as a record.

The Current Supplement.

The Paris correspondent of the SCIENTIFIC AMERICAN opens the current SUPPLEMENT, No. 1431, with an article on the Paris-Versailles road, illustrated by many striking pictures. Sir Oliver Lodge continues his admirable discussion of electrons. Count Arco, who in conjunction with Prof. Slaby invented the Slaby-Arco system of wireless telegraphy, contributes a paper on a new process for tuning spark telegraph stations. Something about the preparation and use of decalcomania papers will doubtless be welcomed. "Restorations and 'Fakes'" is the title of an entertaining archæological article which deals with the skill of the modern craftsman in repairing and remodeling ancient statuary. John D. Rees tells much of interest about domestic life in India. Mr. A. F. Yarrow has made some instructive experiments to ascertain the best design of screw propulsion for shallow-draft boats. His conclusions are published in the current SUPPLEMENT. Mr. William J. Hammer discusses the treatment of diseases by ultra-violet rays.

Third rail troubles from sleet adhering to the rail have been overcome on the line of the Aurora, Elgin & Chicago Railway. A solution of brine, stored in a tank on the front platform of the car, is fed upon the rail through a ¼-inch rubber tube. It is applied 5 feet to 10 feet in front of the first contact shoe, and acts so quickly that the first shoe, it is said, will get current, this treatment apparently rendering the ice a good conductor. Eight gallons of brine suffices, so it is reported, for a run of 24 miles.

Harvey T. Woodman, of Mount Vernon, N. Y., died on May 25. For more than forty years he was engaged in the collection of shells, corals, and prehistoric relics and fossils for museums, colleges, and private collectors. It was he who remodeled Castle Garden into its present Aquarium. He likewise helped to build college museums of natural history for Harvard, Princeton, Columbia, Cornell, and other universities.

Thomas A. Edison has been appointed one of the Board of Technical Directors of the Marconi Wireless Telegraph Company. He has formally transferred to the Marconi Wireless Telegraph Company several patents having a bearing on the transmission of wireless messages. It is rumored that Prof. Michael I. Pupin, of Columbia University, will likewise join the company as a technical adviser.

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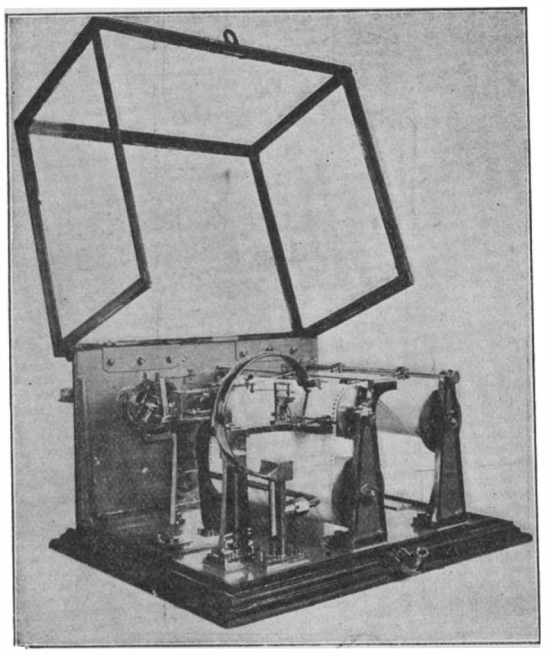
A NEW APPARATUS FOR DETERMINING THE RESISTANCE OF ROAD VEHICLES TO TRACTION.

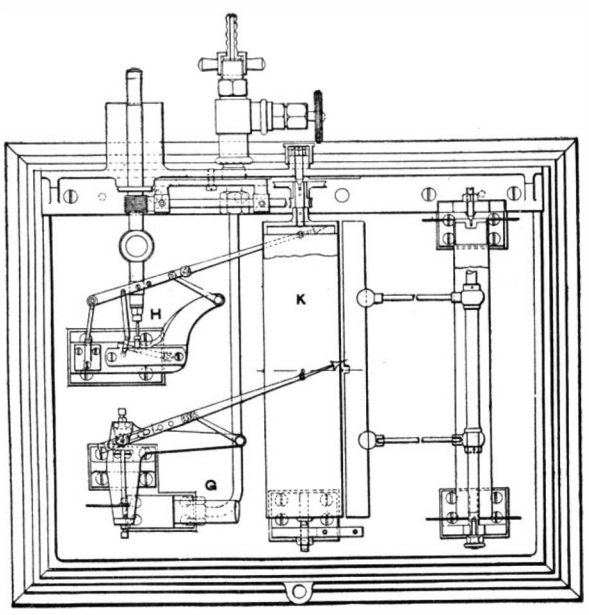
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Some interesting experiments have been carried out for some time past in Great Britain by Prof. Hele-Shaw and a committee of engineering experts, to determine the resistance of road vehicles to traction. Although the scope of these investigations has been conducted upon an extensive basis, they will be of value chiefly to chauffeurs.



GENERAL VIEW OF THE RECORDER.

For the purpose of his investigation Prof. Hele-Shaw devised a new dynamometer specially made for these experiments concerning the resistance of road vehicles to traction. The apparatus comprises a castor frame *AA* shown in the diagram, in which frame is



TOP PLAN OF THE RECORDER.

mounted the wheel *B*; a system of levers *CC* for transmitting to a small plunger *E* the pull exerted on the wheel; and a recording gage for registering the same, as well as a recording tachometer. The castor frame is rectangular in shape and is constructed of wrought iron. The frame is 6 feet in length. The end plates are drilled with three sets of holes, thereby enabling the sides to be adjusted to 10 inches, 14 inches or 16 inches apart to accommodate wheels of various widths. The axle of the wheel to be used for the experiments is mounted on springs one on either side of the castor frame. These springs can be regulated to any desired strength when a light wheel is inserted in the frame, or when a light load is used, by simply removing some of the plates; while if so desired, the axle can be mounted without the springs.

The frame is loaded by bolting a number of 28-pound weights of cast iron to the channel sides of the frame. These weights are made only two inches in thickness, so that when the iron scrolls of the springs do not interfere, 52 or thereabout can be attached, thus giving an aggregate load of 13 hundredweight in addition to the weight of the frame and wheel. This gives a weight corresponding to 3¼ tons on a four-wheeled vehicle. By this system of loading, the weights can be varied by steps of 56 pounds, the weight being always placed equidistant on either side of the frame, so that perfect equilibrium is constantly maintained.

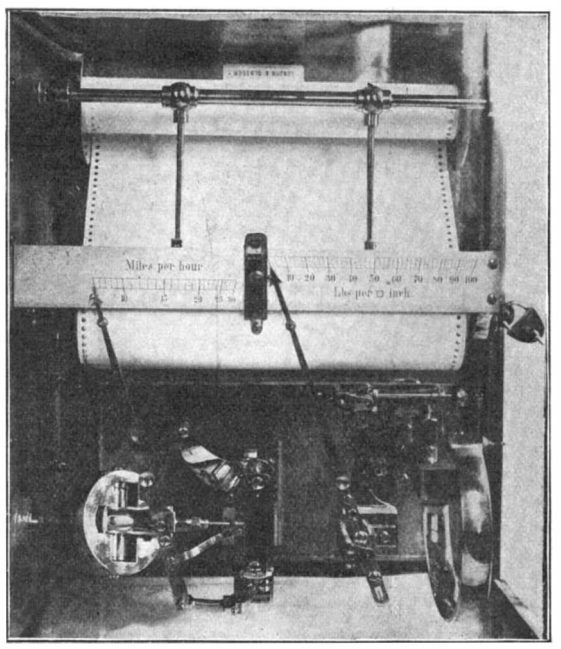
The castor frame is attached to the car by fixture to the levers, which transmit the force to the water by means of a swivel joint *D* so that freedom is given to vibration or vertical bouncing, such as is encountered when traveling over rough, uneven ground, while furthermore it enables the car to follow freely round any curve without disrupting, the records being so held that the experimental wheel is always vertical.

The system of levers is arranged in such a manner that the frame can be raised or lowered to accommodate a wheel of any diameter or any angle of draft without disturbing or altering the leverage of the mechanism. The arrangement of these levers may be described as follows: There is a fulcrum which may be raised or lowered in a vertical slot in a steel casting firmly fixed on the back of the car, upon which is fixed a pair of bell-crank levers. The lengths of these levers from the fulcrum are respectively 14 inches and 28 inches. The longer arm is vertical, and the other smaller lever is horizontal. Two parallel vertical rods of steel, which may be adjusted as desired, are attached to the shorter arm. These rods transmit the pull on the frame to the end of a small horizontal lever, to the other end of which the hydraulic plunger is attached. The fulcrum of this lever is provided with four positions, so that the pressure on the plunger may be made equal to one, two, four, or eight, times the pull exerted on the castor frame. By this arrangement the apparatus may be employed over a wide range of experiments for tractive efforts from 5 to 500 pounds.

The hydraulic plunger *E*, which is 2.6 inches in diameter, exerts pressure upon a rubber diaphragm inclosing a space filled with water, and it is the pressure of this plunger upon the water that is recorded. Two pipes are connected to this water space, the objects of which are to transmit the recorded pressure to the gage, and the other to fill the space with the requisite water. A rubber ball or bulb filled with water is fixed to one end of this latter pipe, and when the ball is squeezed the water is forced through the system and out of a small hole in the Bourdon tube. All air is thus excluded, and the system is then closed and the water retained.

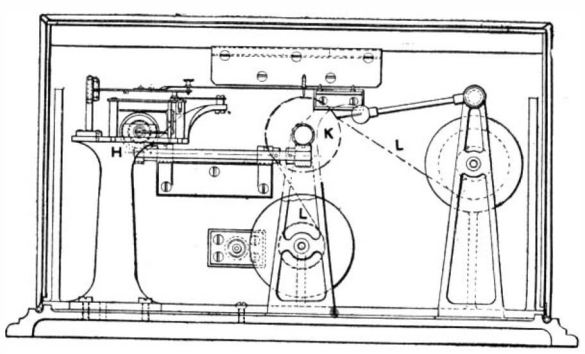
The recording apparatus consists of a combined pressure gage and tachometer mounted on a common base and recording upon an identical horizontal drum carrying a band of paper 8½ inches wide. On one side of this paper is the graph of tractive effort space, and on the other the velocity space. The drum is revolved off the tachometer spindle, so that its motion is identical with the motion of the car, a length of 10.3 on the paper corresponding to a mile of road. This instrument is mounted in a glass case upon a pneumatic cushion with a flexible shaft driving to the drum and tachometer. By this arrangement steady records may be obtained when driving at a high speed over a rough road. Undue shocks on the gage are prevented, by means of stops, which obviate too excessive a movement on the levers. The revolutions of the experimental wheel are also independently obtained by a revolution counter, and this register serves as a check on the record of the apparatus.

The dynamometer was calibrated in the following manner: The car and dynamometer were brought into position on a smooth horizontal floor, and a 40-inch lorry wheel was placed in the castor frame. The car was fixed so as to prevent its moving backward, and a predetermined load was fixed to a wire connected to the top of the wheel and passed over the tire so that it depended vertically; this position exerting the tendency to pull the frame away from the car. A load was applied, and the apparatus submitted to a severe vibration, so as to prevent all possibility of its sticking in any way, the paper at the same time being

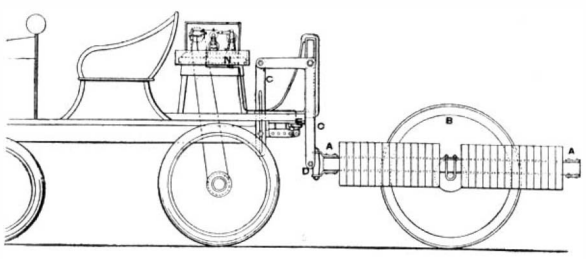


TOP PLAN VIEW OF THE RECORDER, SHOWING THE DRUMS FOR RECORDING THE MILEAGE PER HOUR AND THE POUNDS PER SQUARE INCH.

moved steadily and uniformly until the pencil of the gage occupied the position of equilibrium. This was the *modus operandi* with every reading. During the calibrating of the leverage of 8 to 1, additions of 2 pounds were employed in nearly every case from 0 to



SIDE ELEVATION OF THE RECORDER.

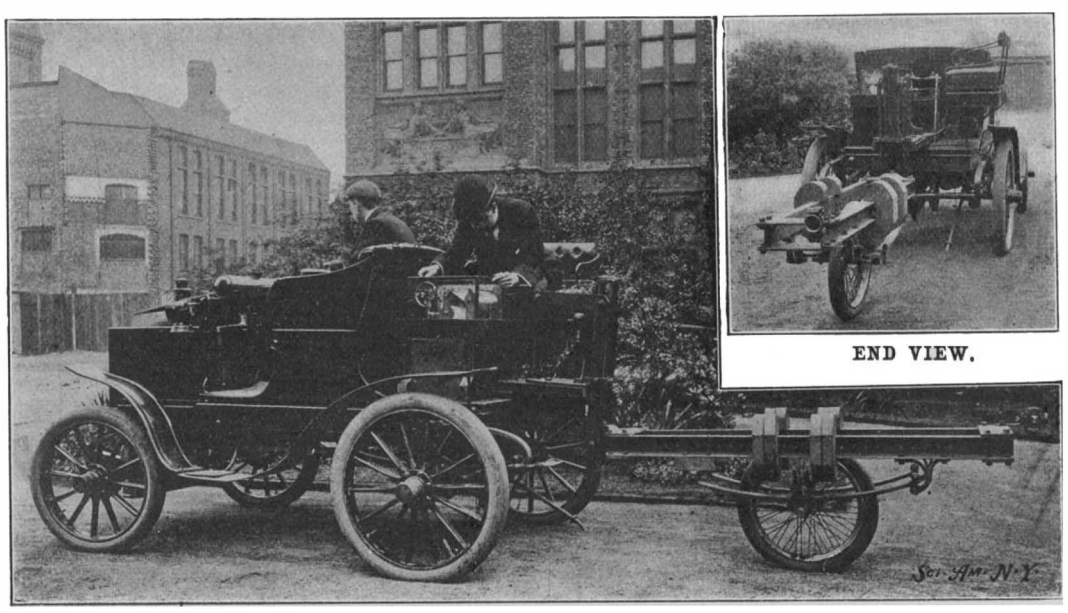


THE DYNAMOMETER APPLIED.

28 pounds. For the 4 to 1 leverage calibration, increases of 14 pounds were taken; after 14 pounds had been reached the highest reading being 168 pounds. The 2 to 1 leverage had 14-pound increments, the maximum being 280 pounds; and the 1 to 1 leverage had increments of 28 pounds up to a total of 580 pounds.

To calibrate the tachometer, an electric motor was utilized. A stop watch for readings of 10, 15, 20, 25, and 30 miles per hour, was employed to time exactly the three revolutions of the drum. Three revolutions of the latter corresponded to 315 revolutions of the tachometer spindle. The mean diameter of the rear wheels of the car is 842 mm. when the car was bearing a normal load, and the tires were normally inflated. The diameter of the pulley on the back axle is 225 mm.; and the diameter of the tachometer pulley is 75 mm.

To operate the dynamometer and the tachometer during a trial, the castor frame is forced toward the car so as to push the ram as far out of the cylinder as it will go. The bulb, which has previously been filled with water, is then squeezed, thus forcing the water into the cylinder, then through the connecting



THE DYNAMOMETER ON THE ROAD.

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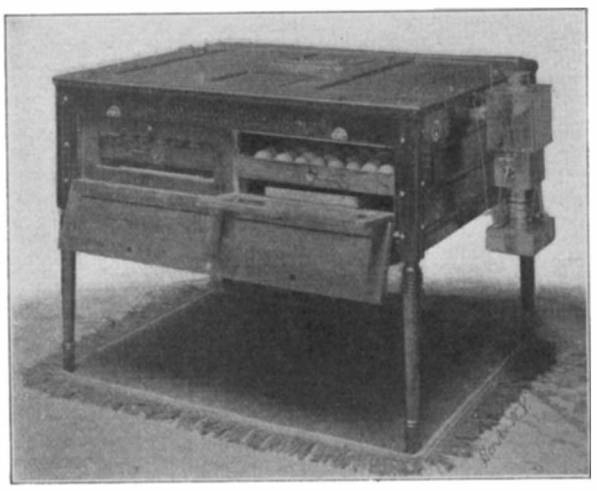
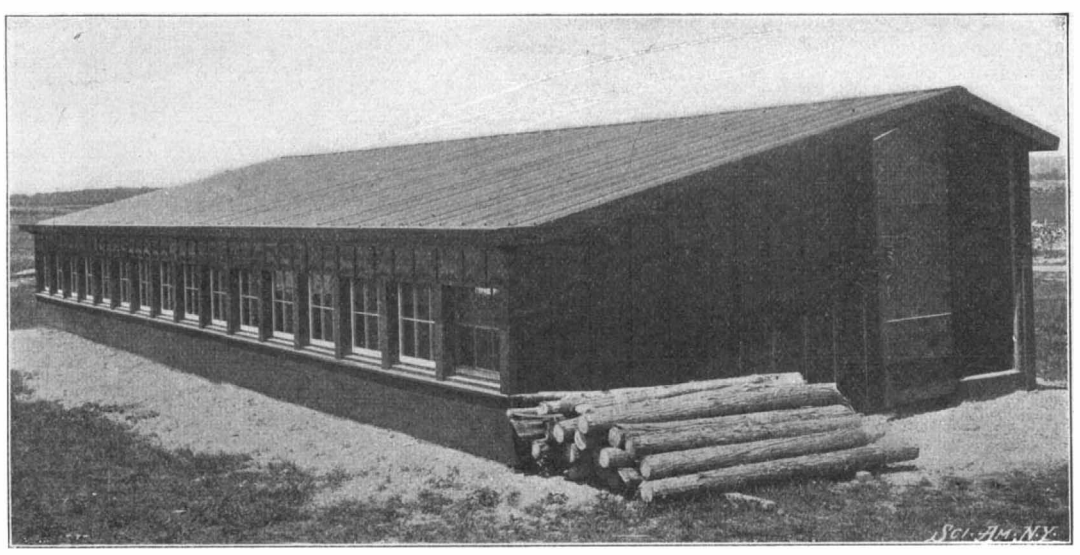
tubing, finally escaping through the pressure gage, as already described. When all the air has been expelled from the cylinder, the cocks at either end of the system are closed. The stops are then adjusted so that the maximum pressure of the water cannot exceed a pressure of 100 pounds per square inch, this precaution being taken to prevent the pressure gage being destroyed, as might possibly otherwise be the case in the event of a greater pressure being exerted. Adjustments completed, a stretch of road is selected for the car to run over for a certain distance, and then back again to the starting point. The return journey is made for the reason that by taking the mean values for the run there and back, it is possible to eliminate the effect of inclines, and thus obtain a perfectly correct result. The load on the car is then augmented and the journey made again, and so on in the same manner, as desired.

The first run was made with a light lorry wheel of 40 inches diameter shod with a 3-inch iron tire mounted on springs of 3 feet 2 inches centers each, with six plates 2¼ inches by 5-16 inch. Three runs were made with this wheel with three loads—3½ hundredweight, 5½ hundredweight, and 8½ hundredweight respectively. The first trial was not attended with any conspicuous success, but another run with exactly the same mountings upon a road paved with sets, the weights being 6 and 8½ hundredweight respectively, at speeds varying from 5 to 14 miles per hour, showed that the tractive effort increased rapidly with the velocity, and at the same time was fairly proportional to the load.

The next experiment was made with a pneumatic wheel measuring 24 inches in diameter by 2¾-inch diameter tires. The springs were exactly the same, but there were only two plates. A macadam road was selected. The run was made with a given load at a constant speed for a distance of about one-half a mile and then back again, the runs being subsequently repeated at speeds of 6½, 8, 10, and 14 miles per hour with loads of 315, 427, 539, and 651 pounds with a leverage of 4 to 1. The result of this test was analogous to the results of Michelin's investigations.



One of the Incubators.



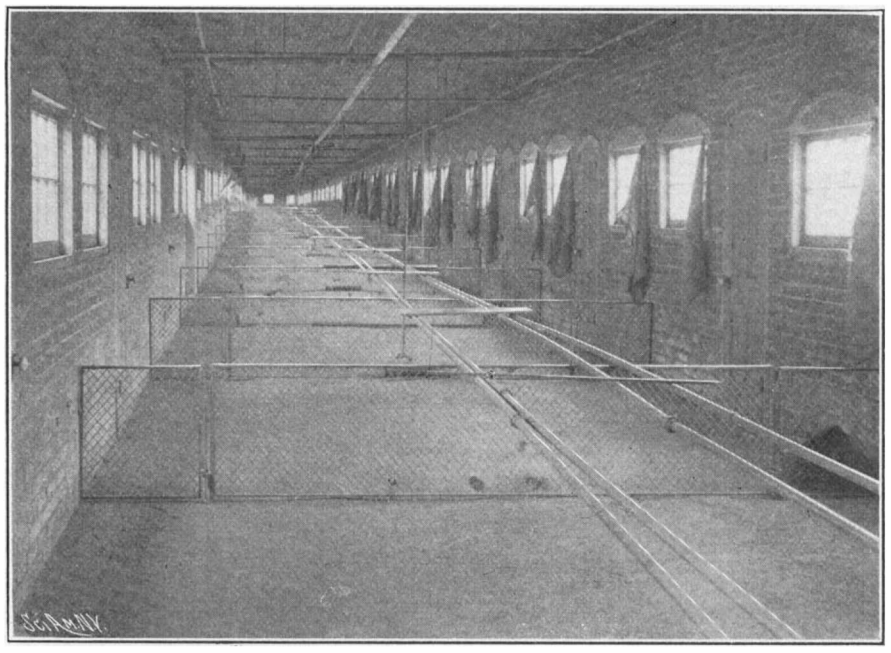
A Modern Poultry House.

The tractive effort was directly proportional to the load, but showed a slight increase with the velocity. Several other experiments of a similar nature have been carried out with highly interesting results. The apparatus works very satisfactorily. The experimental wheel mounted in the castor frame runs very steadily, even under a heavy load and at a high speed. The best-running wheel, however, is the pneumatic-tired, it being found that the lorry wheel oscillates somewhat when running over certain descriptions of roads. The pneumatic cushion is very useful in permitting the recording instrument to work successfully under varying conditions. It prevents the apparatus being subjected to any severe concussions or vibrations, such as might be experienced when running over rough roads, but enables the apparatus to swing gently from side to side. Several further important investigations are to be carried out with the apparatus this year, which it is anticipated will yield valuable information relative to the resistance of road vehicles to traction.

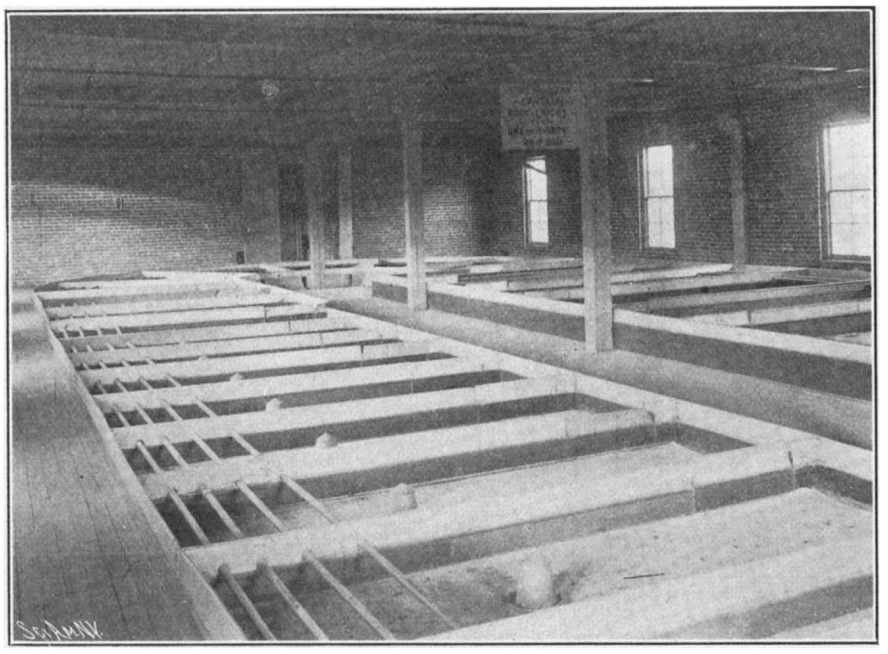
SCIENTIFIC POULTRY RAISING.

The tremendous growth, during recent years, of the poultry and egg industry, which, in point of value of the product, now ranks as one of the leading American wealth-producing activities, has resulted in the introduction of modern scientific methods, which are quite as markedly in contrast to former practices as the advances in any other progressive field of endeavor. Indeed, to present-day achievements in this direction must be attributed the recent development of the American export trade in eggs, which has recently invaded markets as far distant as the Orient.

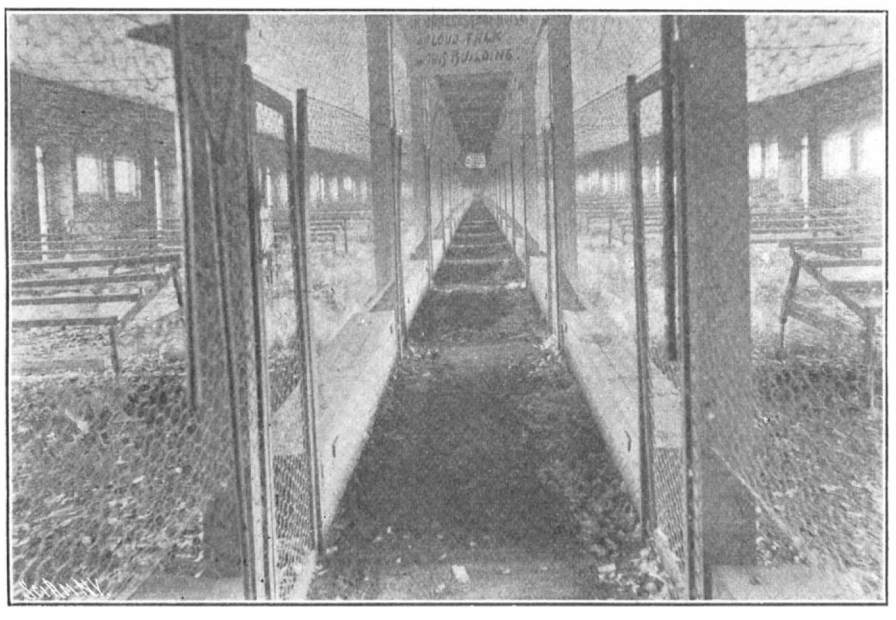
Perhaps the most convincing demonstration of what scientific methods are accomplishing in the poultry industry is afforded by the unique poultry farm at Sidney, Ohio, which ranks as the largest in the



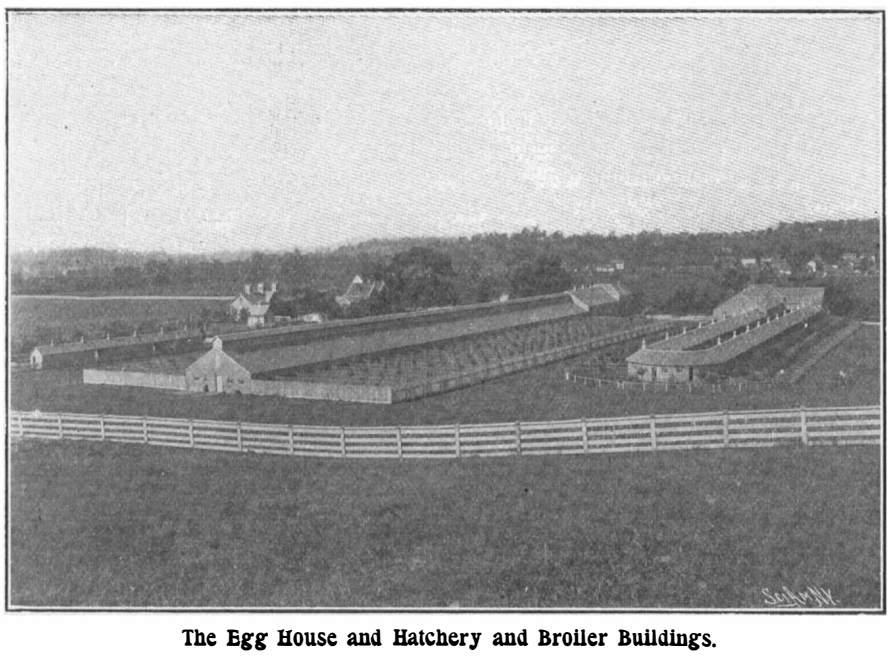
Pens in the Broiler Building.



The Nursery for Newly-Hatched Chicks.



Pens in the Egg House.



The Egg House and Hatchery and Broiler Buildings.

SCIENTIFIC POULTRY RAISING.

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United States, and probably in the world. The buildings which comprise the plant consist of two main structures and a number of smaller inclosures. All are of brick construction, with slate roofs; and more than $100,000 has been expended in buildings and equipment, exclusive of the cost of the site, which comprises one hundred and forty acres.

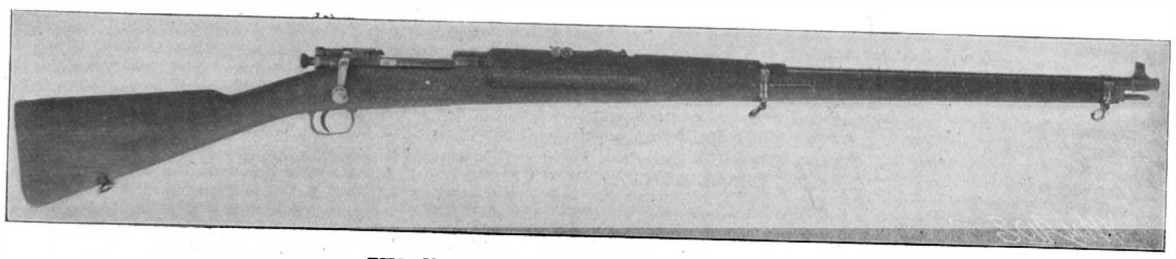
The hatchery, or broiler plant, is 480 feet in length. The main portion of the building is built in the form of the letter U, and has a periphery of 840 feet. In the basement of the other part are thirty incubators, each containing three hundred eggs, so that there is a total of nine thousand eggs daily in a state of incubation. The filling of the machines is so timed that one incubator will discharge its brood each day, and thus the plant may be said to have a daily hatching capacity of three hundred chickens. From the incubator cellar, the small chickens are taken to what is known as the "nursery," which constantly shelters about six thousand young chickens, ranging in age from one to thirty days. When the chickens have attained the age of thirty-one days, they are lowered by an elevator to the ground floor and put in the U-shaped part of the building, which is divided into sixty pens. The chickens advance one pen each day, so that at the end of two months they have completed the circuit and are ready for transference to the shipping department. It may be noted, in this connection, that the U-shaped portion of the building is constantly tenanted by about twenty-one thousand chickens, ranging in age from thirty to ninety days. The egg house at the Sidney plant is 537 feet in length, and similar in construction to the building above described. It is bisected lengthwise by a four-foot aisle, on each side of which are thirty pens containing fifty hens apiece. The three thousand high-grade Leghorn fowls produce daily two hundred dozens of unfertile eggs for culinary purposes. The eggs for the incubators are produced by nine hundred high-grade Plymouth Rock fowls. As indicating the proportion of loss, it may be stated that out of every four hundred and fifty eggs which go into the incubators, an average of three hundred perfect broilers are obtained. Connected with the egg house is an egg washing and marking room, where the date is stamped upon each egg sent to market.

One of the notable advances which have been made by the scientific poultry farmer of the present day is found in the practice of herding chickens. Instead of allowing the hens to run at large as formerly, mingling freely and picking their food from all kinds of refuse, they are now divided into colonies of not more than thirty hens. Each colony has its own reservation, maintained in the highest state of hygienic cleanliness, and each group of hens is separate and isolated at all times from the others. This also facilitates the use of feed calculated to insure the greatest possible productiveness—a subject to which the United States Department of Agriculture, as well as progressive poultrymen, have of late years given great attention; and, as an indication of what has been accomplished in this direction, it may be pointed out that the average yearly yield at these scientific poultry farms is in the neighborhood of two hundred eggs from each hen, whereas under the old conditions the average yearly yield per hen did not exceed forty eggs.

Another advantage of this new policy of segregation is found in the fact that, should a chicken become sick or breed vermin, the trouble cannot spread beyond the one reservation without detection; and thus there is obviated the danger from epidemics such as have frequently in the past resulted in serious loss to poultry raisers. Another new adjunct is found in the automatic nest, which preserves the eggs free from the taint of incubation. No degree of incubation is possible, because, by means of these new nests, the egg is removed immediately after it is laid. The automatic nest has a hole in the bottom, beneath which is a revolving disk that receives the egg as soon as it is laid and moves it away from the nest.

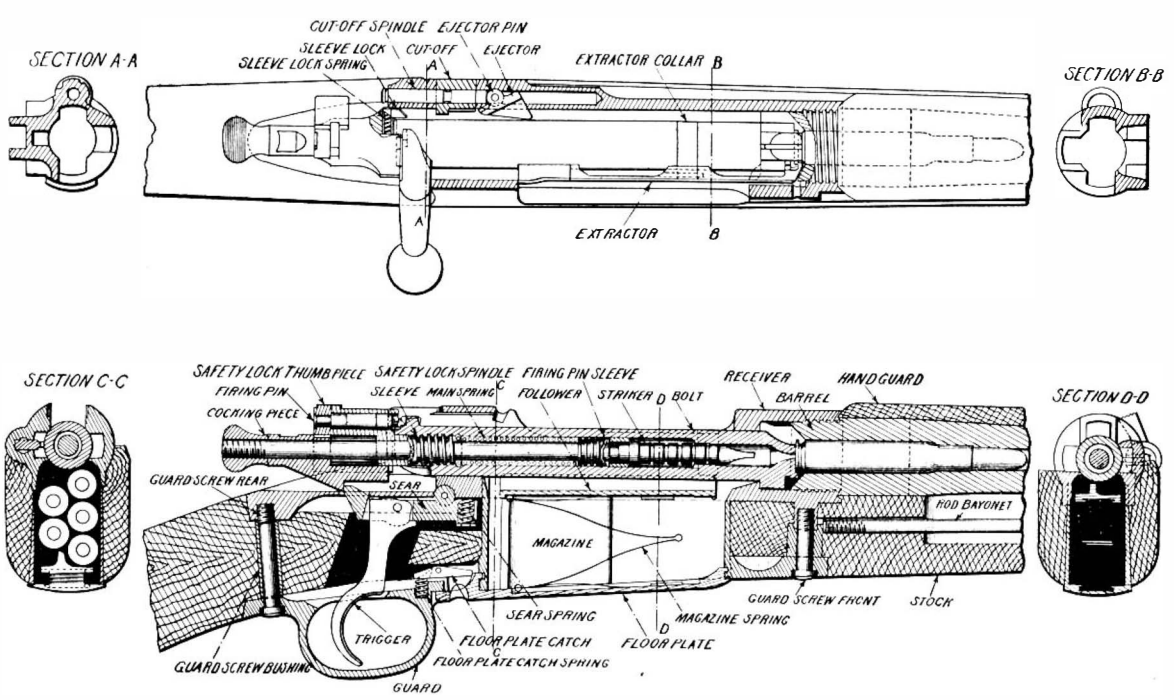
The growth of the poultry business, as conducted on a large scale, could find no more significant criterion than the recent marvelous development of the incubator industry. The center of the incubator manufacturing business is found in the middle West, and one town in Illinois turns out more than fifty thousand incubators every year. It is estimated that not less than five hundred thousand incubators are now in use in the United States. Many of the large poultry farms have incubators with a capacity of one thousand eggs each, and from which there may be hatched ten thousand chickens a year, the loss varying from five to twenty per cent. From a scientific standpoint probably the most interesting incubator plant is that erected by former Vice-President Morton, at Ellerslie, on the Hudson, although ex-President Cleveland has a high-class installation on an experimental farm at Princeton, and President Diaz of Mexico has a costly incubator built especially to his order by an American manufacturer.

Even in the testing of eggs, improvements have been made in the prevailing method. The most effective way of testing an egg is to subject it to the light, but under the old plan, when the egg was held close to the flame of a candle, it almost invariably happened that the shell was blackened. The use of electric light has, however, rendered conditions perfect for a thorough test of the eggs and the utmost speed in handling. A fairly expert tester will examine at least two hundred and fifty eggs a day.



THE NEW SPRINGFIELD ARMY RIFLE.

Muzzle velocity, 2,300 feet per second. Weight of bullet, 220 grains. Weight of charge, 43.3 grains. Weight of gun including bayonet and scabbard, 9.47 pounds.



DETAILS OF THE NEW SPRINGFIELD ARMY RIFLE.

Finally, credit must be given to the new methods of securing speedy transportation for poultry products. Crude "freezers" have been displaced by modern refrigerator cars, and special "dairy trains" now convey eggs from Chicago to New York in less than sixty hours. Even in the event of unexpected delays, no serious loss is entailed, inasmuch as railroads such as the Pennsylvania, which handle much of this traffic, have extensive re-icing plants at various points, where the refrigerator cars are freshly stocked with ice.

THE NEW SPRINGFIELD MAGAZINE RIFLE.

The new Springfield magazine rifle, which has undergone its preliminary tests with very gratifying results, will take the place of the Krag-Jorgensen, which now, for several years, has been doing excellent service in the United States Army. We present a photograph of the gun, which will be known as Springfield Magazine Rifle Model 1902, and also a line drawing which shows several sectional views of the gun. By means of the carefully-lettered parts a good idea is obtained of the details of the gun. The weapon is supplied with a cleaning rod, which can be partially pulled from its place below the barrel, and held with a catch so as to form a bayonet. The great advantage of the rod-bayonet is that it lightens the weight made up of the gun, bayonet, and bayonet's scabbard, and, by dispensing with the latter two as separate articles to carry, permits the soldier to carry with him an intrenching tool of sufficient size and weight to be serviceable. While there is some diversity of opinion as to the value of the rod-bayonet, which is considered to be less effective than the type now in use, it still is of value as converting the musket into a pike. Moreover, in view of the growing value of the intrenching tool and the ever-decreasing opportunities for the use of the bayonet, the substitution of an intrenching tool for the latter is certainly in line with the recent development of field operations. The piece is centrally fed by means of clips, each of which holds five cartridges; and it will be noticed that the bolt has two lugs instead of one as in the old gun. In the last report of the Chief of Ordnance the trials of the piece are spoken of as having given "very satisfactory results." The chief points of difference from the Krag-Jorgensen are this use of two lugs in place of one for holding the bolt against the rearward pressure of the powder—the increased strength so obtained being sufficient to allow of an increase of velocity with the same weight of bullet, from 2,000 feet per second in the Krag-Jorgensen to 2,300 feet per second in the new piece, the resulting increase in muzzle energy being from 1,952 foot-pounds to 2,582 foot-pounds. The Krag-Jorgensen is capable of penetrating 45.8 inches of white pine at a distance of 53 feet, whereas the new weapon penetrates 54.7 inches at the same distance. The striking energy at 1,000 yards has been raised from 396 foot-pounds to 448. Other data regarding the new piece are as follows: The caliber is 0.30; the rifling is made up of four grooves of a depth of 0.004 inch, the twist being one turn in 10 inches. The bullet weighs 220 grains, which is the same as that of the Krag-Jorgensen, but the powder charge has been raised from 37.6 to 43.3 grains. In spite of the considerable increase in its power the weapon has been greatly reduced in weight; for while the present service magazine rifle weighs 10.64 pounds, and the Mauser 10.5 pounds, and the German military rifle 11.54 pounds, the new weapon weighs only 9.47 pounds. It follows, as a matter of course, that, with such high velocity and fairly heavy bullet, the trajectory is correspondingly flat, the maximum ordinate of the 1,000-yard trajectory being only 20.67 feet as against 25.8 feet for the Krag-Jorgensen, 24.47 for the Mauser, and 23.73 for the German military rifle.

In addition to those mentioned above there are other improvements, such as housing of the magazine in the stock directly below the chamber, instead of having it project at the side of the gun, and there are many changes of detail which both improve the rifle and cheapen and accelerate its production.

In closing it should be mentioned that the new gun is considerably shorter than any existing rifle and is only slightly longer than the military carbine.

NEW SPRINGFIELD MAGAZINE RIFLE COMPARED WITH THE KRAG-JORGENSEN, THE MAUSER AND THE GERMAN MILITARY RIFLE.

	Springfield magazine rifle.	Service magazine rifle.	Mauser 7 mm. rifle.	German military rifle.
Caliber .....inches	0.30	0.30	0 275	0.311
Rifling:				
Number of grooves	4	4	4	4
Depth of grooves.....inch	0.004	0.004	0.0049	0.004
Twist, one turn in.....inches	10.	10.	8.66	9.45
Weight of bullet ..... grains	220	220	173	226.82
Weight of charge ... grains	43.3	37.6	38.58	41.2
Weight of complete cartridge, grains	451.15	438.85	385.63	430.24
Initial velocity, feet per second.	2300	2000	2200	2145
Remaining velocity at 1,000 yards.....	958	901	895	906
Muzzle energy .foot-pounds	2581.6	1952	1857.4	2135
Striking energy at 1,000 yards, foot-pounds	447.9	396.2	307.4	413.
Penetration in white pine at 53 feet .....inches	54.7	45.8	50.8	.....
Weight of rifle, including bayonet and scabbard .pounds	9.47	10.64	10.5	11.54
Weight of rifle, including bayonet, scabbard and 100 cartridges. . .....pounds	15.91	16 91	16.18	17.68
Capacity of magazine...rounds	5	5	5	5
Maximum ordinate of 1,000 yard trajectory.....feet	20.67	25.8	24.47	23.73

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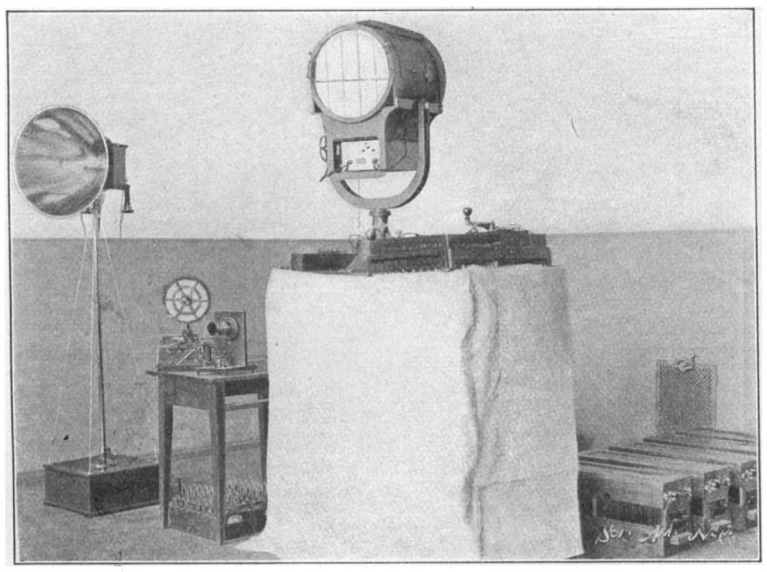
RUHMER'S SYSTEM OF LIGHT-TELEPHONY.

Although Ernst Ruhmer's system of light-telephony has been already described in these columns, the recent experiments conducted by the inventor have attracted such widespread attention that a recapitulation of what he has accomplished should not be without value. For the information herewith presented we have drawn on an excellent paper on selenium prepared by Mr. William J. Hammer, to whom we are also indebted for two of the photographs herewith reproduced.



ARRANGEMENT FOR SPEAKING IN TWO DIRECTIONS.

The vital part of Ruhmer's apparatus is a selenium cell. Selenium is a substance varying in electrical resistance on exposure to light. Among the early investigators who endeavored practically to utilize this remarkable property was Alexander Graham Bell. Twenty years ago he devised his radiophone, in which a mica or glass diaphragm covered with a silvered foil was used to reflect a powerful beam of light upon a selenium cell placed in the focus of a silvered reflector. To the selenium cell were connected a pair of telephones and a battery. At the back of the silvered diaphragm was a flexible tube and mouthpiece into which words were spoken. The sound waves causing the diaphragm to vibrate sent pulsations of the reflected light upon the selenium cell, producing corresponding variations in its resistance and reproducing audible sounds in the telephone. Prof. Bell used this only over very short distances.

In 1898 Prof. H. T. Simon, of the University of Erlangen, discovered that an arc lamp, the circuit of which was in proximity to a telephone circuit, was caused to vibrate very perceptibly. This suggested to him his interesting speaking arc by means of which he superimposed the sound waves produced by the telephone upon the circuit in which the arc was placed. He connected the lamp circuit with the secondary winding of an induction coil, the primary circuit being connected with the carbon transmitter, and a battery. The sounds thus produced originally were very weak; but by employing a suitable carbon microphone, the sound was reproduced to large audiences.

Conversely, the arc could also be used in conjunction with telephone receivers to receive sounds.

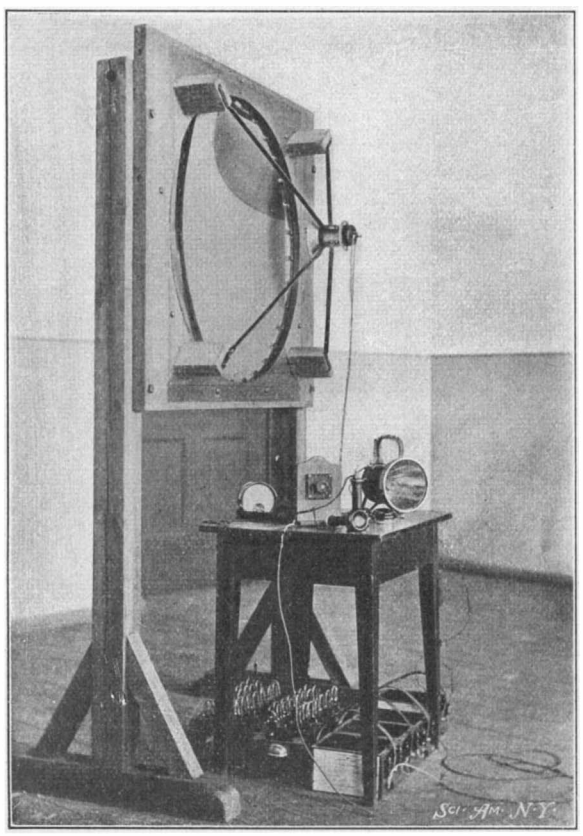
Mr. W. Duddell, of England, has also made some most successful talking arcs. In his arrangement in the secondary circuit is placed a condenser, which prevents the lamp current's entering the induction coil, but allows the induction current in the transmitter circuit to pass without obstruction; and this arrangement has the effect of greatly increasing the sound.

Mr. Ruhmer has ingeniously combined the apparatus of Bell, Simon, and Duddell and has successfully transmitted speech over a beam of light 4¼ miles in length. In his experiments he employed an arc lamp with a flaring arc 6 to 10 millimeters long, using an E. M. F. of 220 volts. The current varied from 4 to 5 amperes at 1 to 2 kilometers, 8 to 10 amperes for 3 to 4 kilometers, and 12 to 16 amperes for 5 to 7 kilometers, and the resistance of his selenium cell was 120,000 ohms in the dark, this falling to 600 ohms in full sunlight. For the transmitting end, Mr. Ruhmer employs a carbon transmitter and a battery superimposing waves on the arc light circuit; and the beam of light is reflected to some distant point, where it is received by a parabolic reflector, in the focus of which is placed a selenium cell connected with a battery and a pair of very sensitive telephone receivers. Mr. Ruhmer has conducted extensive experiments both by night and by day, and even during fog and rain, on the Wannsee, near Berlin.

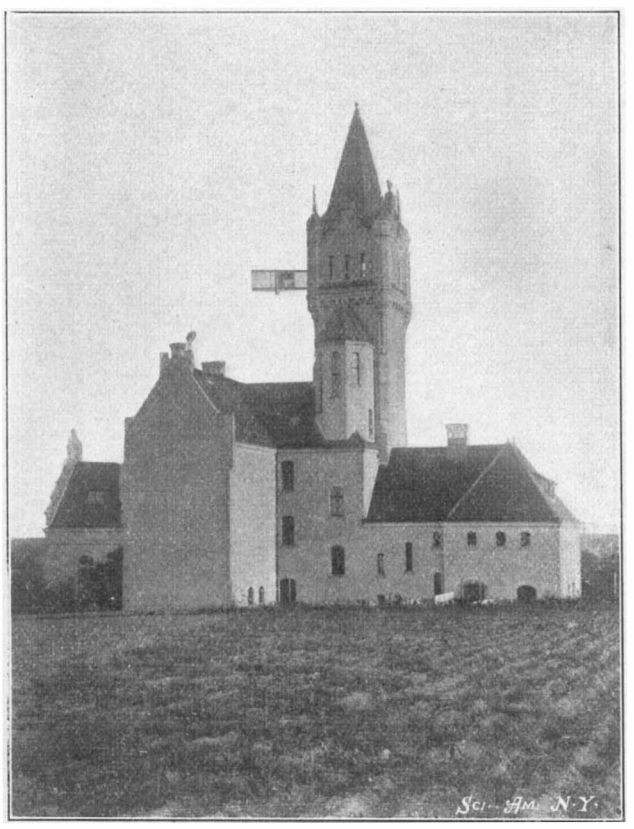
Doubtless many readers remember the interesting experiments made by Mr. Hayes at the Electrical Exhibition held in Madison Square Garden in May, 1899, in which music was transmitted over a beam of light. At one end of the garden was placed a telephone, before which a cornet was played, causing waves of current in the telephone circuit to be superimposed upon those in a neighboring arc light circuit. The light rays from this arc lamp were reflected across the garden, where they were received in a parabolic reflector in the focus of which was a glass bulb containing filaments of carbon. This bulb was connected to a pair of ordinary phonograph listening tubes. The varying light which fell upon the carbon caused variations of temperature inside of the glass bulb, which produced the original sounds in the listener's ear. A bulb simply coated with lamp black and containing nothing but air, would answer the purpose just as well.

Selenium cells may vary in resistance from 2,000 ohms to 500,000 ohms or more in the dark; and certain cells may be five to twenty times as good conductors of electricity in light as in the dark; and in the case of the Ruhmer cell used in the Wannsee experiments, will have 200 times the conductivity in light that it has in the darkness; and the ratio may be even higher.

Ruhmer's latest type represents, probably, the most important development which has been made in the selenium cell, and it has now become most stable, and responds most rapidly to variations in illumination. He employs two copper wires, wound spirally side by side around a cylinder of porcelain, which, after the wires have been covered with selenium, is placed inside of a globe, which is exhausted. The cylinder is mounted with a butt similar to an Edison incandescent lamp, and resembles a candelabra lamp. This makes a most convenient method of handling the cell; and by keeping it from the air the disadvantages inherent in all cells heretofore have been very largely done away with. Another form of Ruhmer cell consists of two fine platinum wires wound on a glass cylinder 1¼ inches long and ¾ inch in diameter; the wires, which are 1-32 of an inch apart, are coated with selenium.



RECEIVING STATION OF RUHMER'S SYSTEM OF LIGHT-TELEPHONY.

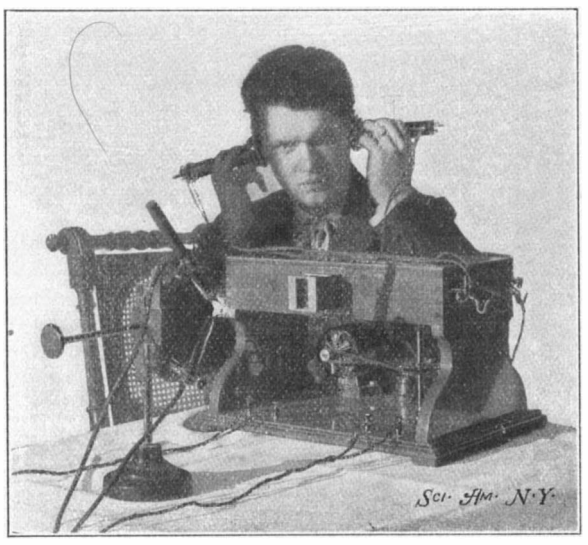


RUHMER'S STATION ON THE OUTSKIRTS OF BERLIN, SHOWING THE HUGE MIRROR.

An expedition is to be sent out by the Royal Geographical Society of London to relieve the British Antarctic ship "Discovery," which is said to be caught in the southern ice pack and to be in serious difficulty.

Liquid Air for Cooling Purposes.

One of the claims made for liquid air was that it would be "the cold-producing medium of the future." Not only would the working of our modern refrigerating and freezing stores be accomplished by means of liquid air, but everybody—the manufacturer in his workshop, and alike the agriculturist on his farm—might, at trifling cost, procure a cool and pure atmosphere for himself. Considering that liquefied air, vaporizing at atmospheric pressure, possesses a temperature of —191 deg. C., it is hardly a matter of surprise that, with such an energetic cooling medium in view, the problem of applying liquid air for refrigerative purposes is raised again and again.



THE RECEIVING INSTRUMENT.

In the consideration of the merits of any particular source of cold two points are essential—first, the quantity of cold produced, i. e., the number of heat-units eliminated per unit of time; and second, the intensity of the cold, i. e., the temperature at which heat is removed.

The most important physical law relating to the production of cold is well known as determining that the expenditure of energy necessary for a certain amount of cold increases in direct ratio with the difference between the lower temperature (in the refrigerator) at which the heat is taken away and the upper temperature (in the condenser or cooler) at which heat is transferred to the cooling water or to the atmosphere. Now, if the refrigerative purpose be the production or the maintenance of a temperature only a few degrees below the freezing-point of water, then, according to the law referred to, it must be exceedingly irrational to employ liquid air, seeing that for its attainment we are compelled to descend to —191 deg. C. (—312 deg. F.)

Supposing that anyone had to provide a well for obtaining surface-water from a depth of 10 feet, it would be insane to sink a shaft down to 300 feet, to let the water run from its surface-level down this pit, and then to raise it to a height of 300 feet. But this exactly corresponds to the idea of persons recommending the use of liquid air as a substitute in all the refrigerating machines of to-day. If we were to work our ice factories, our cooling and freezing stores, and our other cooling plants by liquid air, the requisite expenditure would be from thirty to fifty times greater than that of our modern refrigerating installations.—Dr. Carl von Linde, in Cassier's Magazine.

Cedar and pine trees are rapidly being consumed for the purpose of supplying trolley and telegraph poles, and at the present rate of consumption, it will not be a great while before the visible supply will be exhausted. The foresters look to catalpa to fill the place of pine and cedar in this particular. The catalpa flourishes in a great many places in this country, and has the advantage of growing very straight, and attains the needed size in from sixteen to eighteen years. The time required for cedar and pine is more than double this.

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Legal Notes.

A Railroad Switch Patent in Court.—The case of Pettibone, Mulliken & Co. against the Ajax Forge Company (118 Fed. Rep. 733), recently decided by the Circuit Court of Appeals for the Seventh Circuit, brings out an interesting state of facts. The patent in suit was one granted to Strom on August 18, 1891, for a switch. In a split switch the movable rails are planed to a point, respecting their width. The point-rails are coupled by a tiebar, which, by means of its connections with the lever of a switch-stand, throws the switch. As the switch is set for the main or the side track, the appropriate point-rail should be brought into close contact with its adjacent stationary rail, while the other should stand several inches away from its fixed neighbor. If the contact is not close, the flanges on the wheels of engines and cars are likely to cause disaster. By the wearing of the rails, and of the bolts and nuts used in connecting them to the tiebar, as well as by the accidental bending of the tiebar, or other disarrangement of parts, the original fixity of relation between the point-rails becomes impaired, and the switch is made dangerous. At least twelve years before the Strom patent was granted, means were employed for spreading the point-rails to take up lost motion.

Three claims were made, the first covering in combination a split switch and a connecting medium for the switch rails, adjustable lengthwise thereof; the second covering in combination, a split switch and a tiebar connecting the switch rails and adjustable lengthwise thereof to set the gage; and the third claim covering in combination, a split-switch and a tiebar extending obliquely between and connecting the switch-rails and adjustable at one end lengthwise of the adjacent rails to set the gage. None of these specific devices was ever made or used. Appellant marketed split switches made under the Strom patent of 1891, and under a patent granted in 1895. The former is called the "Channel" switch; the latter is referred to as the "Transit" device. In the "Channel" patent, guard-rails are rigidly attached to the switch-rails and extend some little distance beyond the points. The extensions are bent inwardly toward each other in the plane of the rail-flanges. The spreading of the switch-rails is accomplished by moving a bar forward into the throat of the convergence, and fastening it by means of plates that slide along the web of each rail, and are attached thereto at the proper point, in a series of bolt-holes. In the "Transit" construction, to each switch-rail is rigidly fixed a plate that extends inwardly in the plane of the rail-flanges. In each plate is a series of holes in a right line that runs obliquely to the line of the rail, toward either the point or the heel of the rail. The switchrails are spread by moving a bar forward and bolting it at the proper points in the plates.

The appellee manufactured split switches under the Bradley patent of 1900. To each switch-rail is rigidly fixed a plate that extends inwardly in the plane of the rail-fingers. In each plate is a circular opening with notched circumference. In the opening fits a toothed disk that has an eccentric bolt-hole. A bar, having its jaws at each end, is securely bolted, through the eccentric holes, to the disks and plates. The separation of the switch-rails to compensate lost motion is effected by changing one or both eccentric bolt-holes to a point further removed from the rail.

In affirming the decree dismissing the bill the Court remarked that in the bottom of appellee's argument was to be found the contention that each of the claims sued on is generic and covers every construction in which the connecting medium between the switch rails is used to separate them by being moved lengthwise the rails.

The Court cites several patents to show how old this device of Strom's is. The Court found that the first and second claims were not infringed because the appellee's device was not within the alleged new way, depending for its efficiency solely upon the normal convergence of the switch-rails. The third claim was not infringed because it was in the old field and must be limited to the means stated.

Tesla "Split Phase" Patent Declared Invalid.—The Westinghouse Electric Manufacturing Company brought an action against the Catskill Illuminating and Power Company, alleging infringement of two patents granted to Nikola Tesla, December 26, 1893. The Circuit Court sustained both patents, and found infringement of both claims of the one patent and of the first claim of the second patent. An appeal was taken by the defendant, the result of which was that the Circuit Court's decree was reversed.

The two claims of the first patent in issue (511,559) are as follows:

"1. The method of operating motors having independent energizing circuits, as herein set forth, which consists in passing alternating currents through both of said circuits and retarding the phase of the currents in one circuit to a greater or less extent than in the other.

"2. The method of operating motors having independent energizing circuits, as herein set forth, which consist in directing an alternating current from a single source through both circuits of the motor and varying or modifying a relative resistance of self-induction of the motor circuits and thereby producing in the currents differences of phase as set forth."

The first claim of the second patent in issue (511,560) is as follows:

"1. The combination with a source of illuminating currents and a circuit from the same, of a motor having independent energizing circuits connected with the said circuit and means for rendering the magnetic effects due to the said energizing circuits of different phase, and an armature within the influence of the said energizing circuits."

The system of operating electrical motors by means of alternating current from a single original source covered by these claims is technically known as the "split phase system."

Tesla was the inventor of what is known as the polyphase system of transmission, which he covered in earlier patents and applications for which were filed during the fall and winter of 1887 and the winter and spring of 1888. Patents were finally issued May 1, 1888.

By the methods and means described in the patents in suit Tesla dispensed with one of the line circuits and was able to run a motor by means of an alternating current from a single original source, which was accomplished by the process and by the apparatus described in the claims cited, the phase of the current in all circuits being so retarded, or the relative resistance of the motor circuits being so varied as to maintain the necessary difference of phase in the circuits. This utilization of a single original source by splitting a single current into two currents was an improvement of great practical value.

On April 22, 1888, there had been published in Milan, in an Italian journal, a report of a lecture by Prof. Galileo Ferraris, in which the system covered by the patents in suit was fully described. In the opinion of the court this printed publication was such a disclosure of the subject-matter of the patents in suit that, if prior thereto, it would constitute an anticipation. Witnesses were introduced by the complainant to prove that Tesla was not anticipated by Galileo Ferraris. The testimony offered was not very satisfactory to the court. In view of the inadequate testimony offered of priority on Tesla's part, the court held that Tesla did not prove that his invention antedated that of Galileo Ferraris.

Patents and the Anti-Trust Law.—The General Electric Company brought an action against Wise (19 Fed. Rep. 922) for an infringement of the Tournier patent No. 559,232 for an incandescent lamp socket. The defendant set up an alleged anticipation by the Weston socket and the Westinghouse push button socket. The court, however, held that both of these latter devices failed to accomplish the result sought and obtained by the devices of the Tournier patent. It is a well-known principle of patent law that a patent for an invention which successfully accomplishes a useful result is not void for anticipation or prior use because of the prior device, however similar in combination or close in resemblance to that of the patent, where such device was not operative and failed to produce the result sought, which result is, however, produced by the device of the patent. The defendant in this suit set up as a defense that the complainant is a member of a combination in violation of the anti-trust law of July 2, 1890. But the court held that even this circumstance did not give the third person the right to infringe a patent of which the complainant was the owner; nor did it preclude the complainant from maintaining a suit in equity to enjoin the infringement.

The Kodak Cases in England.—The verdict in the long and closely contested suit by the Eastman Kodak Company against several English manufacturers for alleged infringement of their registered trademarks, "Kodaks," "Brownie," "Bull's Eye," etc., has been rendered. The decision of the judge, Mr. Justice Swinfen Eady, who took great pains to bring out all the points in the case on both sides, is wholly in favor of the Kodak Company and is so succinct and far-reaching in its scope that it is thought there will be no appeal. Briefly stated, the bone of contention was that when customers of certain houses asked for a "Brownie" film or a "Bull's Eye" film, meaning, of course, a film to fit a Brownie or Bull's Eye camera, they were supplied with other makes of film which were got up in size and requirements to fit these cameras. The Kodak Company stated in their complaint that they had no objection to the general use of the trade names, which they claimed as their own property, if they were used in a certain manner. For example, if the film was said to be a film for an F. P. K. or Brownie as the case might be, but if a customer asked for a "Brownie" film he must be supplied with a Kodak make of film. The decision of the judge was fairly rendered and establishes a precedent. Having coined certain words and registered them as descriptive of certain goods of their own manufacture and created a demand by extensively advertising the same they are justly entitled to protection in the benefits to be derived therefrom.—Am. Amateur Photographer.

An English Fels-Naphtha Trade-Mark Decision.—Before Mr. Justice Byrne in the Chancery Division, the case of Fels against Hedley & Co. recently came up for hearing. The old question was raised as to the right of a manufacturer to appropriate a word in common use for the purpose of describing his goods. The plaintiffs were the well-known American soapmakers, who introduced both in the United States and England a household soap widely advertised by the name "Fels-Naphtha." The defendants subsequently introduced a soap which they called "Ladybird Naphtha Soap." Both articles were widely sold. The plaintiffs sought to restrain the defendants from designating their goods by any title in which the word "naphtha" formed part, unless precautions were taken clearly to distinguish their goods from those of the plaintiffs. It was contended that the words "naphtha" and "naptha" in connection with soap had come to be used by the public to denote Fels-Naphtha soap and no other. The court, however, was of the opinion that the word "naphtha" as applied to soap was a descriptive word, and had not acquired the particular meaning which the plaintiff claimed. An injunction was, therefore, refused.

The English law upon this subject of trade names is much the same as in this country. In a case which came before the House of Lords in 1899, Lord Davey said that "a man who takes upon himself to prove that words, which are merely descriptive or expressive of the quality of goods, have acquired the secondary sense to which I have referred, assumes a much greater burden—and, indeed, a burden which it is extremely difficult to discharge—a much greater burden than that of a man who undertakes to prove the same thing of a word not significant and not descriptive, but what has been compendiously called a 'fancy word.'"

The Right of Privacy.—Unauthorized Use of Portraits as Trade-Marks Prohibited by Statute.—The Rochester Folding Box Company case has called forth so much criticism that the Legislature of the State of New York has felt compelled to pass an act prohibiting the use of the name or portrait of any living person for purposes of advertising or trade without the written consent of such person. An injunction may be obtained and suit may be brought to recover damages for any injury sustained by reason of such use. If the defendant shall have knowingly used a name or portrait in the manner forbidden, the jury may use its discretion in awarding exemplary damages.

The question presented by the case was by no means new. It had been decided time and time again in the same way in this State. The court simply held that the right of privacy has as yet received no judicial recognition. Even if it had received judicial recognition, it would not be within the province of a court of equity to protect it; for a court of equity cannot protect absolute personal rights. The so-called right of privacy is founded upon the claim that a man has the right to pass through this world, if he wills, without having his picture published, his business enterprises discussed, his successful experiments written up for the benefit of others or his eccentricities commented upon in handbills, circulars, catalogues, periodicals, or newspapers, and, necessarily, that the things which may not be written and published of him must not be spoken of him by his neighbors whether the comment be favorable or otherwise.

Obviously, if a court of equity could logically protect such an absolute right by injunction, a vast amount of litigation would result bordering upon the absurd. A court of equity would then be compelled to restrain the publication of libels, or in a word to assume quasi-criminal jurisdiction, which it never had and which it was never intended that it should have. The statute which has been passed gives a court of equity the power which it has hitherto lacked, and which will prevent the unauthorized use of any person's picture for advertising purposes.

When infringement would necessarily or naturally result from the ordinary use of a device, a defendant cannot escape liability for infringement merely by showing the possibility of a different use. The decisive question is whether the operation of the alleged infringing device when in use is the same and produces the same results.

An idea is not patentable, but only the particular mechanical device or combination for carrying it into effect.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

DOUBLE PLOW.—R. V. E. RASMUSSEN, Emdrup, Copenhagen, Denmark. This new improvement relates to double plows designed especially for plowing on inclined surfaces, as the sides of hills, and is constructed to be used in either direction, having the beam mounted to turn to coact with either share. The plow works easily, and the position of the beam can be quickly changed.

PLOW.—S. V. JEFFORDS, Waycross, Ga. In working young plants, the furrows should be formed as near as possible to the roots. Working close up to the plants with a shovel or half-shovel cultivator is objectionable, as the dirt is thrown beyond the plants or upon them, with mashing-down or bending-over results. To overcome such objections, Mr. Jeffords has invented an attachment adapted to be used with any type of plow or shovel cultivator whereby sliding action of the sod up the plow is obstructed, with effect to break and loosen it, the better adapting it for hilling up young plants.

Engineering Improvements.

ENGINE.—G. COLOMBO, North Bergen, N. J. In the present case the improvement has reference to an engine adapted particularly for use in connection with steam as a motive force, the engine being provided with a new and novel form of continuously-turning valve and a cut-off working therewith.

ATTACHMENT FOR AIR-BRAKE SYSTEMS.—J. W. ALEXANDER, Bridgeport, Ohio. The particular object in view in Mr. Alexander's invention is to provide a drum or reservoir with a blow-off attachment which may be operated from a locomotive-cab and which subserves two purposes—first, to remove the water accumulated in the drum, and, second, to suddenly relieve air-pressure in the train-pipe as required for an emergency-brake.

VALVE MECHANISM.—J. T. FENTON, Philadelphia, Pa. This device belongs to the class employed in multiple-cylinder engines, and the object of the invention is to provide a valve mechanism arranged to control the admission and exhaust of the motive agent to and from the cylinders in proper succession, to allow of using the motive agent expansively, to permit of varying the cut-off, quickly reversing the engine, and shutting off the motive agent when desired.

Hardware.

ROPE-CLAMP.—J. S. HERMANSON, West Superior, Wis. In the operation of this device, the rope in the clamp is free to move downward and to the left, but not in the opposite direction. The least movement upward and to the right causes the rope to bear upon a channeled surface, thus forcing the teeth of a movable jaw toward the teeth of a stationary jaw and firmly securing the rope. By means of a handle the rotund portion of a cam can be forced into engagement with the upper end of the movable jaw, thereby causing the teeth to move asunder, thus releasing the rope. The teeth grip the rope as soon as the handle is released.

IMPLEMENT FOR APPLYING AND CLINCHING FENCE-WIRE CLAMPS.—G. H. WRIGHT, Spokane, Wash. In this implement, one object is to bend the fastener around the wires and to bend the wires themselves at the point of intersection; another, to so construct the parts of the tool that the clamp may be placed in the tool, and by a slight movement of the bending-jaws the clamp is seized by the jaws so as to be held in the implement; another, the provision of bending-jaws to seize the clamp, and to bend parts of the latter around the wire; and another, to provide means for holding the tool against displacement on the wires, and being operable with the jaws, so as to open for the application of the tool to a line-wire.

CLAMP.—R. H. MAKOWSKY, New Haven, Conn. This case relates to improvements in clamps for the use of cabinet-makers and other woodworkers, the object being to furnish a clamp of simple construction that may be used as an ordinary clamping device and also may be employed as a vise adjustably connected to a bench.

COLUMN-CLAMP.—A. A. LOETSCHER, Dubuque, Iowa. A means for clamping together masses of material is provided by this device. In use, a chain is thrown loosely around the object to be clamped, and a screw is rotated in the proper direction to move the blocks apart to a maximum distance. The chain is next drawn as taut as convenient by inserting a hook in some one of the links intermediate of the end of the chain. Then grasp the handle, turn the screw, and tighten the chain around the structure.

SASH-LOCK.—J. MAC VANE, Riverside, R. I. This construction locks both sashes in closed positions or when either or both are opened for ventilating. The lock is carried by one sash and equipped to move the bolts simultaneously to their retracted positions, the bolts being projected to their operating positions by springs and adapted to separately engage with a pulley-stile and the other sash stile. A lever carries a dog which engages with the bolt for the upper sash, and in the path of the lever drops a detent for holding the lever against operation, the detent being placed in an inaccessible position from an implement inserted between the meeting-rails of the sashes.

Mechanical Devices.

CUTTING ATTACHMENT FOR CORNICE-BREAKS.—G. R. BYDE, Fresno, Cal. Mr. Byde's invention relates to certain novel and useful improvements in slitting or cutting attachments for cornice-breaks, and has particular application to a mechanism of the type employed for cutting sheet metal or the like of various widths. The machine is constructed so that it is easily attached to ordinary cornice-breaks.

MOVING-PICTURE APPARATUS.—G. M. HIGGINS, Cleveland, Ohio. The prime feature of the invention is the arrangement of lenses mounted to move continuously in an endless path parallel with and at a speed proportional to that of the moving film, these parts moving past the light-admitting orifice, so that the lenses operate successively upon the film, and the parts moving in exact time with each other insures accurate impressions and avoids that objectionable appearance of vibration common to apparatus of this sort. The operation is reversible, and there is an arrangement facilitating the reproduction of the colors of the subjects taken.

CUTTING DEVICE FOR BUTTER, LARD, ETC.—B. HAMBLET, New York, N. Y. It is the purpose of this invention to provide a new and improved cutting device more especially intended for the use of grocers and other retail merchants selling butter and the like by the pound and arranged to enable the grocer to mechanically and accurately cut the product in the tub or like receptacle into parts of a predetermined weight without the use of scales or other weighing devices.

CRANE.—L. S. FLECKENSTEIN, Easton, Md. This mechanism may be classified as an improvement in cranes whose principal parts are a vertically-rotatable post, a horizontal arm or jib permanently attached to the post, and a winch or drum for winding up the hoisting chain. The crane has many advantages in respect to simple construction and the application of power.

VENDING-APPARATUS.—R. C. KELLY, Davenport, R. STROPPEL, Cedar Valley, and P. F. WYJACK, Iowa City, Iowa.—These inventors have secured patent rights on a machine adapted especially for vending cigars from the boxes in which they are packed, and the vending apparatus is associated with certain peculiar coin-controlled devices, so that upon the insertion of a coin into the machine a cigar will be delivered.

Railway Improvements.

RAILWAY-TIE.—J. S. MILLER, Clinton, Neb. This invention relates to improvements in railway-ties, the object in view being to provide a tie, consisting partly of wood and partly of metal, so constructed that the rails may be prevented from spreading and will rest on the wood portions, thus obtaining the requisite elasticity.

RAILWAY-RAIL.—G. A. CASE, Joplin, Mo. This sectional rail constitutes an improvement over the construction covered in a prior patent of Mr. Case. The present invention is directly concerned with the base or main section of the rail; and the object is to construct this section tubular so that compressed air or fluids of any sort may be transmitted through the rail without interfering with the use of the rail in its ordinary capacity.

MAIL-CRANE.—T. J. CONWAY, Blanchester, Ohio. Certain useful improvements in automatic mail-cranes or mail-delivery devices are provided by this invention, the object of which is to provide a mechanism of this character capable of being readily placed in position for immediate use. After a mail-bag has been taken away from the automatic mail-crane by devices on a passing train, the crane automatically swings away from or into a position parallel with the track.

FOLDING CAR-STEP.—N. GRAY, Louisville, Ky. In this contrivance the improvement has for its object a novel construction and combination of parts whereby the folding car-step may, together with the vestibule-door, entirely close the outer side of the vestibule when the folding step-section is closed and by which this section may be closed through the aid of a trap-door forming an extension of the car-platform when properly adjusted.

CAR-AXLE BOX.—J. MALTRY, Omaha, Neb. The principal object of this improvement is to provide for a constant supply of lubricant to the journals of the axle and to prevent the entrance of dust into the oil or lubricant chamber. Another object is to so construct and arrange the parts that the chamber may be readily removed or detached from the journal.

Vehicles and Their Accessories.

BICYCLE.—B. F. MODISETT, Helena, Ark. The parts in this construction are organized in a new way, so as to bring the carrying-wheels into parallel relation and to suspend the weight of the load close down to the ground. An improved steering device insures the control of the wheels separately by levers within reach of the hands and these levers may be shifted so as to steer on any course or to simultaneously move the wheels to positions for arresting without a brake. The machine is equipped with a mechanism adapted to use the power of the hands and feet to secure high speed. The frame is so mounted on the axles as to reduce the shock when a wheel drops into a rut or depression.

RUBBER TIRE.—R. AUSTIN, Brooklyn, N. Y. This tire comprises an endless member of resilient material, provided with bearing-plates spaced apart and buried therein, each plate being provided with central perforations and mutilations upon its edges, for anchoring the central portions and the edges firmly within the resilient material, and a wire within the material and encircling all of the bearing-plates. This wire is totally disconnected from the plates and spaced asunder, so that the material forms a cushion as between the bearing-plates and the wire.

Miscellaneous.

STOVE OR RANGE.—B. F. ALLEN, St. Louis, Mo. Improvements in stoves and ranges are provided by this invention whereby the heat generated in the firebox can be utilized either for cooking or quick baking by shifting dampers, so as to cause the heat to traverse around the oven before reaching the chimney or to direct the heat into the heating-chamber under the top plate without causing the heat to pass around the oven.

NON-REFILLABLE BOTTLE.—J. C. GUSTAVESON, Providence, Utah. This bottle has for its object the provision of a construction which will permit the contents to be dispensed, but will prevent its refilling and will include means whereby to prevent the insertion of wires or other instruments to displace the valves arranged to prevent refilling.

FIRE-ESCAPE.—J. TRIPLETT, Campbellsville, Ky. The particular object in this improvement is to provide a simple construction readily applicable to a door, window, or other support in or adjacent to a room, and by which safe descent can be made by means of a rope or cable and in so doing will elevate another rope, so a second person can descend, who in turn will raise the first rope, so that an unlimited number can escape by alternately using the two cables supplied to the apparatus.

TOOTH-BRUSH.—C. A. TORRANCE and G. S. STONE, Talmage, Neb. The purpose of these inventors is to provide a tooth-brush so made as to feed an antiseptic solution to the bristles for the prevention of disease. The brush is furnished with a hollow member having an inclosed measuring-chamber and suitable valves and connections for regulating the admission and discharge of an antiseptic liquid from the chamber to the bristles of the brush-head.

SUBMARINE CONSTRUCTION.—L. L. RINALDI, Somerville, Mass. This invention relates to the construction of piers, sea-walls, lighthouses, and the like; and the object is to provide a submarine construction arranged to permit of placing the building-blocks in proper position below the water-level to securely fasten the lowermost layer of blocks in place on the bed of the waterway and form a secure, durable and accurate foundation in quiet waters as well as in strong currents.

SELF-FEEDING MATCH HOLDER AND IGNITER.—C. H. SCALES, Toronto, Canada. Provision is made in this holder for the safe storage of matches in a manner to expose them for ready access, so that they can be withdrawn individually for use, thus saving the quantity used, which is an item where matches are offered gratis. A striker is associated with the magazine to facilitate ignition of the match on the withdrawal thereof from the magazine, thus avoiding striking matches against a wall. Means are supplied for receiving burned matches, and also to enable the holder to be used in connection with matches of different lengths.

JAR.—J. A. MAXSON, Cogar, Oklahoma Ter. The purpose in this invention is to provide a new and improved jar for containing fruits, preserves, meats, and other fruit products and arranged to insure hermetic sealing of the mouth of the jar to protect the contents against air, moisture, and other influences tending to spoil the goods.

ANIMAL-YOKE.—W. M. LANDERS, Lawn, Texas. Mr. Landers' invention has reference to improvements in animal-yokes, particularly for cattle, the object being to provide a simple and comparatively cheap construction that will prevent an animal wearing the yoke from passing through a wire or other fence. It may also be applied to horses or mules.

CAMEO GLASS.—A. H. FREEMAN, Mount Vernon, N. Y. The intention in this improvement is to provide a new cameo glass designed for use in colored-glass windows or other articles utilized for ornamental purposes or for glassware and arranged to represent in relief any pattern or predetermined design in the desired colors to produce a highly artistic effect and enhance the appearance of the article.

PRINTER'S GALLEY.—W. A. FAUCETT, Raleigh, N. C. In this case the aim is to provide a galley which will hold in proper condition type-set matter that is subsequently transferred to the bed or "stone" for "make-up" into "form" by keying such matter in columns within a chase. Measuring scales for the galley show the length of a "slug" of type-set matter at a glance, and facilitate the making up of a column of predetermined length by avoiding the application of a rule thereto.

HYPODERMIC SYRINGE.—T. A. CHAPPELL, Bronwood, Ga. This syringe has an expansible plunger-head and means for expanding the head and relieving it from pressure. It is so constructed that it may be charged from the side, and when a tablet is introduced it will be pressed by the plunger-head at its inward movement against an anvil-surface within the body of the syringe, crushing the tablet and dissolving it quickly. This invention relates to one previously patented by Mr. Chappell.

DEVICE FOR TEACHING PENMANSHIP.—W. W. FRY, Philadelphia, Penn. That class of devices for teaching penmanship in which a slotted sheet or backing is associated with a guide-copy, is represented by this invention. The object of the invention is the provision of means whereby a series of guide-copies may be interchangeably placed in position before the pupil and in which each copy is held in place and flat by devices adapted to permit the easy and quick introduction and removal of the copy.

FARM-GATE.—J. T. YAGER, Brownsboro, Ky. The purpose of this improvement is to provide a farm-gate adapted to open from either side and so to hinge the gate to a swing-post and an operating-lever mounted on the post that when the lever is moved upon its pivot the first action of the gate will be to raise itself at its outer or free end, thus disconnecting the gate-latch from its keeper, the next action of the lever swinging the gate and opening it in the desired direction. The operating-lever carries means for preventing the gate when swung closed from passing beyond the closed position and when the gate arrives at this position to carry the checking means out of checking action.

COPY-HOLDER.—S. C. HOYLE, Bryan, Texas. The purpose of the inventor is to provide a holder which will keep the place during the task of copying and will turn the leaves of the shorthand-book, thus obviating the removal of the book from the holder until all the copying is completed; and, further, to provide means for automatically operating the device through the medium of the carriage of a typewriting machine or manually, as may be convenient.

LAMP.—B. NADEAU, Boston, Mass. This lamp is of that class intended to be used with gas as a fuel and to carry an incandescent mantle. The aim of the invention is to improve the lighting efficiency of the lamp, which end is attained by certain features and parts serving to confine the heat to the immediate vicinity of the burner, thus facilitating the combustion of gas.

RECORD ATTACHMENT FOR WAITERS' OR MERCHANDISE CHECKS.—A. WYSE, New York, N. Y. This recorder's purpose is to provide a device for use of waiters' and merchandise checks to carry a duplicate of the amounts of individual checks used during a given period or a duplicate of the totals of individual checks, and means enabling a checker to as readily make the entry on a tally sheet as on the check. Another purpose is to place the record in an endless form upon a support, and to provide means to enable each waiter, checker, or salesman to have at hand during the service a complete duplication of prices of articles sold during such time and enabling persons comparing accounts to have before them a record of sales made by each one employed during specified periods of time.

HEATER.—O. F. ROGGENKAMP, Seneca, Kan. In operation the drum of this heater is to be filled with fuel such as corncobs or long sticks of wood standing upright. The combustion will take place in the base or fire-box, and the products of combustion will pass through the drum and the pipe. This self-feeding heater may be made of comparatively light metal.

COMBINED WATER HEATER AND CONDENSER.—W. TATE and M. L. CABLE, Greensboro, N. C. The inventors have for their object improved means whereby feed-water for steam-boilers and heating plants generally may be more effectually heated by exhaust-steam or return water from radiator heating systems. Means are adapted to condense exhaust-steam and the water thereof be mingled with the feed-water as it passes through to a hot-water pump operating to force the heated feed-water into the boiler.

PICTURE-HOLDER.—EMMIE C. ETHERTON and G. E. POWELL, Atlantic, Iowa. The intention of the inventors is to provide an improved holder manufactured from spring-wire in such a way that it may be expeditiously applied to pictures, plaques, photographs, mats and other flat objects, so as to securely engage therewith. The device may be equipped with a leg member adapted to support the holder and the article engaged therewith in a standing position.

DRESSER.—J. L. LARSON, Butte, Mont. The invention relates particularly to improvements in the arrangement of mirrors for dressers, the object being to so mount a plurality of mirrors that their angle may be adjusted one independently of another for such relative adjustment that a person may at one time receive the reflection from the front and sides or from the front, sides and back.

Designs.

DESIGN FOR MATCH-SCRAPER.—A. B. RISLEY, Hoboken, N. J. The design consists in a background which represents a barn, a match-receptacle which is in the form of a feed-box and represented as supported in close relation to the barn, and in the exhibition

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of a donkey in relief waiting for the feed supposed to be in the feed-box.

DESIGN FOR A BOX-COVER.—H. L. CROLL, New York, N. Y. The design is produced on the top of a box cover and consists in a major wreath, inclosing two minor wreaths, and these minor wreaths respectively inclosing portraits.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 4231.—For manufacturers of aluminium hones for sharpening knives.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4232.—For makers of Ferris wheels for use at fairs and summer resorts.

Morgan Emery wheels. Box 517, Stroudsburg, Pa.

Inquiry No. 4233.—For makers of fans driven by spring motors.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 4234.—For catalogues, prices and descriptions of automobiles suitable for a livery.

Blowers and exhausters. Exeter Machine Works, Exeter, N. H.

Inquiry No. 4235.—For makers of light, portable band sawmills.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 4236.—For makers of plows with an elevator attachment for placing dirt into wagons.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 4237.—For domestic and foreign manufacturers of inflatable rubber toys, such as balloons, etc.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4238.—For a machine for cutting wire into lengths and winding it around a small package.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4239.—For a steam jacketed vulcanizer for making artificial rubber limbs, etc.

MANUFACTURERS! Want any parts made of any metal? Write us. Metal Stamping Company, Niagara Falls, N. Y.

Inquiry No. 4240.—For makers of wire cushions for invalid chairs.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4241.—For dealers in second-hand pool and billiard tables.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4242.—For a mechanical lawn grass (not leaf) rake.

FOR SALE.—Patent No. 670,482. Hat fastener clasping head as did old elastic, but is applied under hair. Address Emma T. Miller, Urumia, Persia.

Inquiry No. 4243.—For makers of apron springs for use of sporting men, etc.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

Inquiry No. 4244.—For makers of shot guns, hammer and hammerless guns, etc.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4245.—For makers of hose, hose reels, cut-off nozzles, spanners, hydrant wrenches, axes, etc.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 4246.—For makers of small steel castings or small steel pressed work.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4247.—For dealers in "Wheatstone's Dial Telegraph Instruments."

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4248.—For dealers in phosphorescent sulphide of calcium.

WANTED.—A competent and energetic foreman for brass manufacturer making brass fittings. One who is a good manager of men and systematic in the handling of work, also practical in designing tools. A growing opportunity for the right man. Address with references "Brass Manufacturer," Box 773, New York.

Inquiry No. 4249.—For machinery for grinding bones for fertilizing purposes.

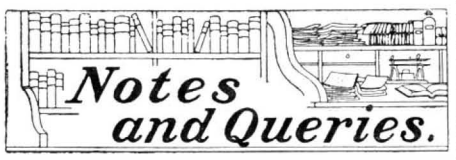
FOR SALE.—Patent desk calendar (No. 722,765, March 17, 1903) accepted by four San Francisco wholesale stationery houses for regular drummers' line for Pacific coast. A money maker for party who has means to introduce extensively. F. H. Smith, 2019 Broadway, San Francisco, Cal.

Inquiry No. 4250.—For makers of adding machines.

Manufacturers desired for the manufacture under royalty of valuable U. S. air compressor patents. Invention great success and growing rapidly into large use abroad. Principals only dealt with. Full particulars on application to Box 722, c. o. Judd's, 5 Queen Victoria Street, London, England.

Inquiry No. 4251.—For information as to the new telephone system lately devised.

WANTED.—A factory superintendent for progressive manufacturer of brass and iron fittings. A man versed in general machinery and tool practice and thoroughly systematic in management of work and output. Must be qualified in the handling of men and perfectly reliable for taking charge of factory. Give references and address "Manufacturer," Box 773, New York.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(9035) J. T. K. asks: 1. I want to magnetize a needle to saturation, steel ⅛ x 1-16 inch, 3, 6 or 12 inches long (but I suppose the length would not make any difference, so it was long enough for the winding). How many ampere-turns should I use? How long should the current be kept in the circuit? A. To magnetize a bar of steel by a battery, wind a coil of a few turns of wire of such a size that the bar will slip easily through it. Connect it to the current, and pass the bar back and forth a few times from the middle to the end and then to the other end, etc., stopping at the middle before cutting off the current. If you have an electromagnet with an iron core such as a telegraph sounder, you can magnetize a small bar by drawing it from end to end along one of the ends of the core of the electromagnet. It is well to draw it in the opposite direction along the other core, also, the same number of strokes to each core. If you would use a dynamo current for the magnetizing, you may connect the coil or electromagnet for the purpose in series with a lamp, arc or incandescent, and use the current which lights the lamp to do the work. 2. Have you a SUPPLEMENT that explains how to wind a transformer for a certain output, both step-up and step-down? That is, how many primary turns to how many secondary turns? If not, where can I get a book at low cost that will tell? A. We have not published any plans for transformers. You will find some in the book "Electrical Designs," which will take 200, 400, or 1,000 volts, and deliver 18, 32, 50 or 100 volts, or the reverse.

(9036) A. W. writes: During a late residence of five months on the highland of Bolivia at 13,000 feet above sea-level, I noticed that all colorless transparent glass assumed a deep violet hue after a short time. The neighborhood is flat and sandy, forming the bed of a dried-up lake. The district is subject to violent electrical disturbances. Borax, magnesia and niter are present. Can you tell me the cause of the violet color of the glass? A. We should look for the cause of the discoloration of the glass to some substance in the region rather than to the altitude. But we are not able to explain the case satisfactorily to ourselves. Some reader may have knowledge on the matter.

(9037) A recent note gave figures for the pressure used in organ bellows in pounds per square inch. It is the custom of builders to rate the pressure to be used in the organ in inches of water, determined by the difference of level in the two arms of a "U" tube, one arm of which is connected to the bellows. In our statement the error was made to give as pounds per square inch figures which should have been given as inches of water. A firm of builders has given us the following data: "Pressures of air usually employed are 3 to 3½ inches on the manual pipes, and 3½ to 4 inches on the pedals. In very large organs this is very often increased as high as 8 inches on the pedals and from 8 to 15 inches where there is a solo organ."

(9038) W. L. W. asks: Requiring to gild the first surface of a glass mirror whose surface must remain optically true, we have tried the formula furnished by Prof. Schwarzenbach. The experiment has failed entirely, although conducted with care. Can you say also whether any particular method for making the marsh gas is required to insure purity? A. The following process, devised by Wernicke and improved by Böttger, will undoubtedly give thorough satisfaction. Three solutions are prepared. *a*. Dissolve 1 gramme pure gold in aqua regia, evaporate to dryness in the water bath to expel excess of acids, take up with water and dilute to 120 cubic centimeters. *b*. Dissolve 6 grammes pure caustic soda in 100 c.c. of water. c. Reducing solution: Dissolve 2 grammes dextrose in 24 c.c. water and add 24 c.c. alcohol and 24 c.c. acetaldehyde of 0.870 spec. grav. This solution should always be freshly prepared, as it deteriorates on standing. For gilding, mix in the ratio of 64 c.c. of solution *a*, 16 c.c. of solution *b*, and 1 c.c. of solution *c*. The glass surface to be gilded should be cleaned thoroughly with caustic soda solution, but not with acid. Marsh gas is obtained in pure form by mixing 2 parts sodium acetate, 2 parts caustic potash and 3 parts quicklime, and heating the mixture.

(9039) M. K. McQ. says: 1. What amount of electricity is used in decomposing a given amount of water? A. One coulomb of electricity will decompose water so as to give 0.000010384 gramme of hydrogen and 0.00008286 gramme of oxygen. This is an amount of current given by one ampere flowing at a pressure of one volt for one second. Any other amounts are calculated easily from this. 2. Give a formula or recipe for a cement that will firmly unite meerschaum and silver. As a subscriber of the SCIENTIFIC AMERICAN I cannot say enough in its praise as an up-to-date scientific publication. *a*. Dissolve good glue in water and add half as much linseed oil varnish and one-quarter as much Venice turpentine as the amount of glue used. *b*. Mix 3 parts copal varnish, 1 part linseed oil and varnish, 1 part oil of turpentine and 1 part glue. *c*. Mix Canada balsam with carpenters' glue 2 ounces and Venice turpentine ½ ounce.

(9040) O. R. B. asks how to lag pulleys. A. Cast-iron pulleys may be lagged with leather without the use of rivets, by first brushing over the surface with acetic acid, which will quickly rust it and give a rough surface; then attach the leather to the face of the pulley with cement composed of 1 pound of fish glue and ½ pound of common glue. *To Cover Pulleys with Paper.*—Scratch the face of the pulley with a rough file thoroughly, so that there are no bright or smooth places. Then swab the surface with a solution of nitric acid, 1 part; water, 4 parts; for 15 minutes; then wash with boiling hot water. Having prepared a pot of the best tough glue that you can get, stir into the glue a half ounce of strong solution tannic acid, oak bark, or gallnuts, as convenient to obtain, to a quart of thick glue; stir quickly while hot and apply to the paper or pulley as convenient, and draw the paper as tightly as possible to the pulley, overlapping as many folds as may be required. By a little management and moistening of the paper, it will bind very hard on the pulley when dry, and will not come off or get loose until it is worn out. Use strong hardware wrapping paper.

(9041) G. F. M. says: 1. Do you know of a process to remove iron rust, fats or acid stains from marble, without cutting it down? A. Grease spots can often be removed by applying over the spot some fuller's earth or powdered chalk, saturated with benzine; let lie for a few hours, then remove and scour. Acid stains cannot be removed, as they eat into the marble. Iron stains can sometimes be removed by the use of hot strong caustic soda solution. Oxalic acid is much more likely, however, to remove the stain, but will more or less attack the marble. 2. What substance will produce the greatest volume of gas when brought in contact with fresh or salt water? A. Metallic lithium will probably yield the greatest volume of gas when brought in contact with water. Theoretically, 7 pounds of lithium will yield 1 pound of hydrogen gas, equivalent to over 5,000 liters, or about 180 cubic feet.

(9042) G. W. says: Would you please send me a receipt for making a good library paste, one that will keep for an indefinite length of time and one that would answer the purpose of a photo-mounter? A. Dextrine forms the base of nearly all library pastes. The dextrine is treated chemically, and the manufacture is entirely unlike that of ordinary pastes. Many of these pastes are patented. We have no definite formula. For $1 we will look up and send two or three copies of patents which will give you an idea of the composition and methods of manufacturing such pastes.

(9043) J. J. McV. says: Can you inform me where I can obtain the following information in regard to wood pulp? 1. About what is its weight per cubic foot when in the pulp? Also its weight per cubic foot after it has been compressed into the solid form? A. Wood pulp is always put on the market in the form of a coarse board; the specific gravity in this form will vary, being dependent on the nature of the wood, the method in which the pulp has been made, and its relative dryness. We cannot find any figures published, and doubt whether any determinations have been made of its specific gravity. 2. Can it be made impervious to moisture, and reasonably free from decay, if placed in the earth? And does the process of making it so materially increase the cost? A. The treatment to which pulp is subjected in the manufacture of indurated ware, fiber pipe or papier mache makes it quite impervious to water. The cost of such treatment is considerable, relative to the cost of the wood pulp itself. 3. When compressed into the solid form what is its tensile and shearing stress per square inch? A. We know of no records of these tests. 4. What is the approximate cost per cubic foot or pound of the compressed product when made from the coarsest, cheapest kinds of timber, in large quantities? A. We have no information on this subject. 5. What is the process of making the pulp from the coarsest timber? And also how is it made waterproof? A. There are two general methods, mechanical and chemical. The mechanical is simply a grinding operation. The chemical method is subdivided into two, the soda method and the sulphite method. Descriptions of the methods of making wood pulp are beyond our limit of space, but the details can be found in all chemical technologies. It is waterproofed with rosin dissolved in boiled linseed oil.

NEW BOOKS, ETC.

INDIA RUBBER AND GUTTA PERCHA. By T. Seeligmann, G. L. Torrilhon and H. Falconnel. London: Scott Greenwood & Co. New York: D. Van Nostrand Company. 1903. 8vo. Pp. 402. Price $7.50.

A complete practical treatise on these two gums, dealing with the historical, botanical, arboricultural, mechanical, chemical, and electrical aspects is this work, translated from the French by John Geddes McIntosh. The literature of rubber is extensive, as is shown by the excellent bibliography. It is rather surprising that the invention of vulcanization is credited to Nelson Goodyear instead of Charles Goodyear. It is to be hoped that the error will be corrected. The book is an excellent one, but some views of American rubber plants might have profitably been included, also rubber-tire making. Foreign authors are apt to forget that the rubber industry was brought to perfection by American inventors. Thomas Hancock does not deserve much credit for what he did, and the story is not given in the volume before us.

LE NAVIRE POUR PASSAGERS. Essai sur un Type Nouveau de Navires sans Tangage et sans Roulis Evitant Ainsi le Mal de Mer aux Passagers Inchavirables et Insubmersibles aprés Abordage. Par C. Turc, Lieutenant de vaisseau, Ancien élève de l'Ecole polytechnique. Paris: E. Bernhard et Cie. 1903. Pp. 88.

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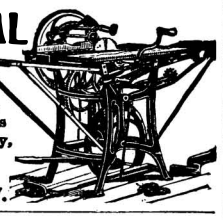

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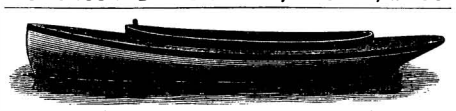

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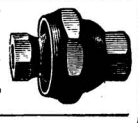

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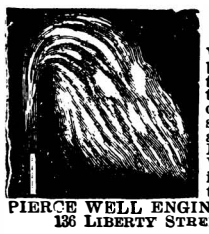

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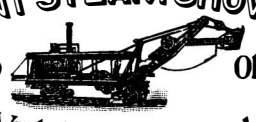

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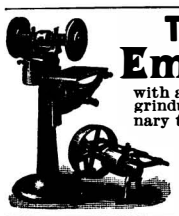

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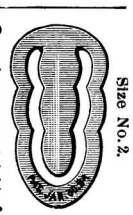

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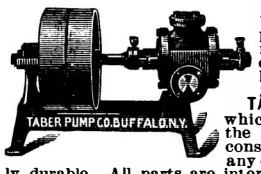

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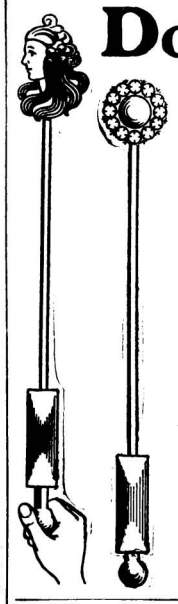

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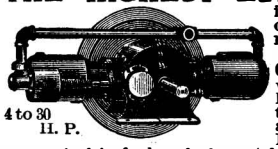

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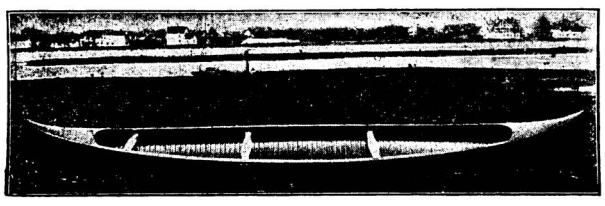

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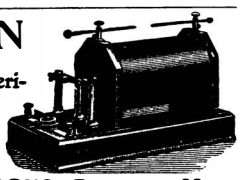

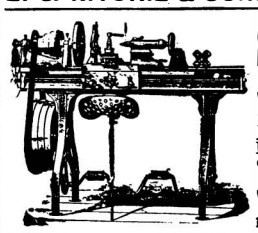

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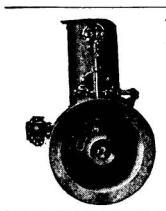

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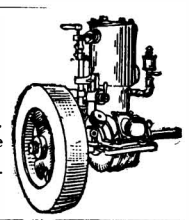

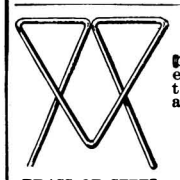

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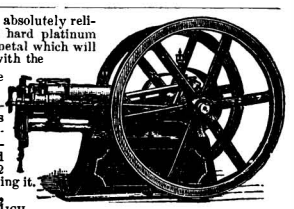

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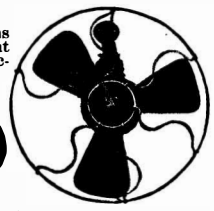

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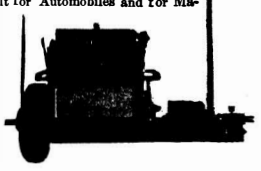

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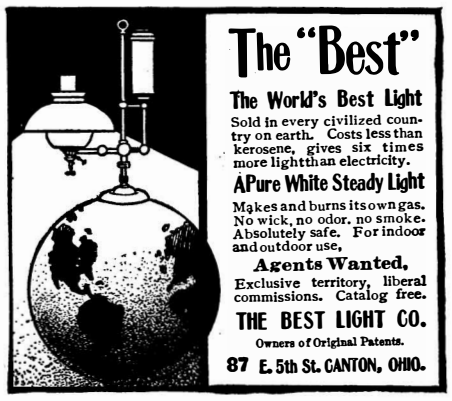

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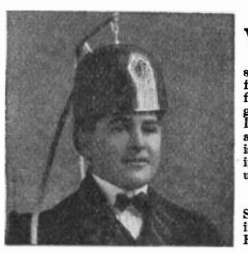

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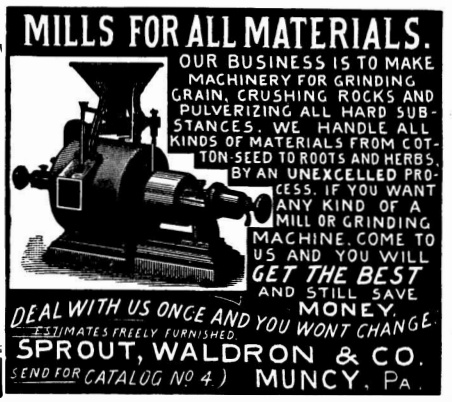
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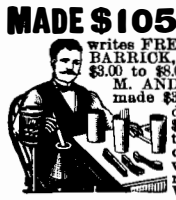
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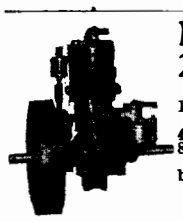
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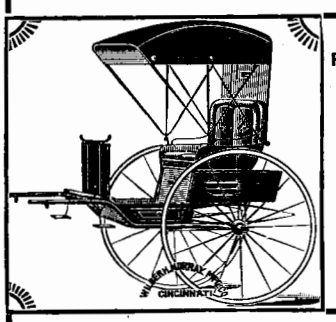
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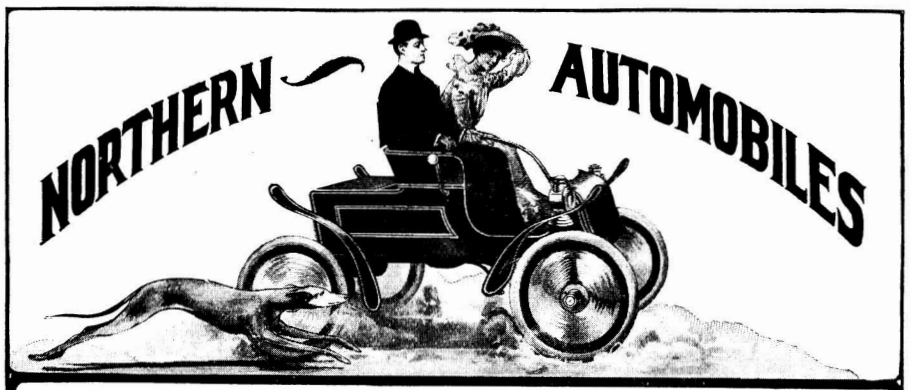

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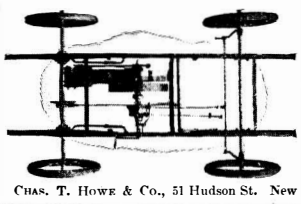

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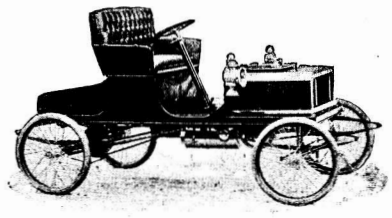

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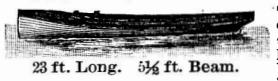

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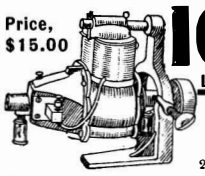

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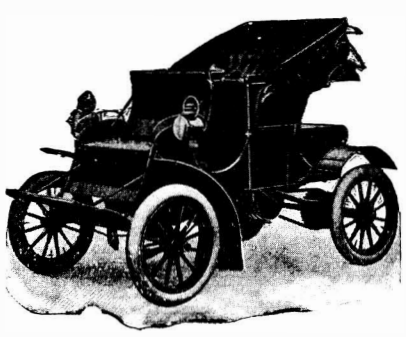

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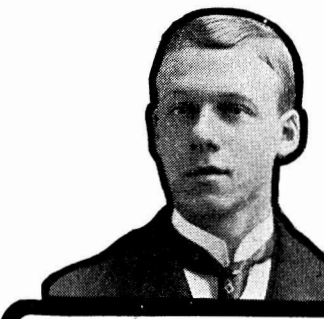
(*Continued on page 441.*)



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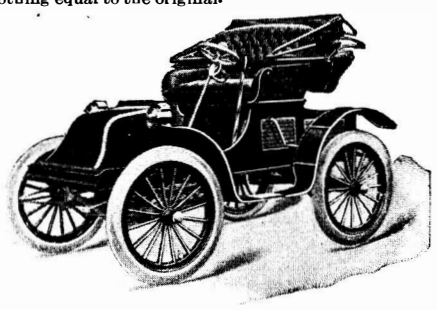

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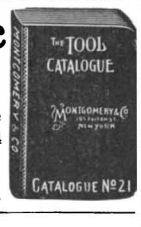

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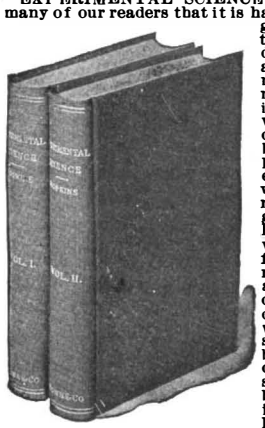

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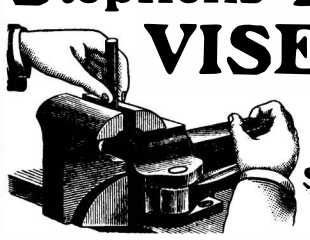

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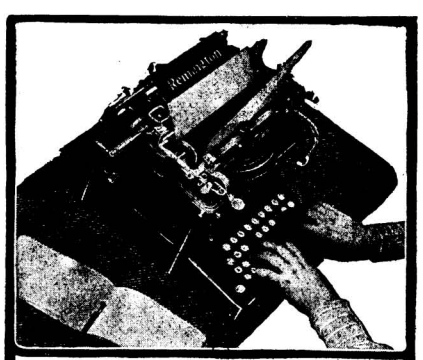

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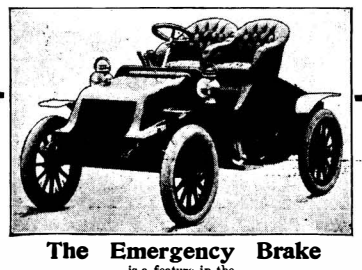

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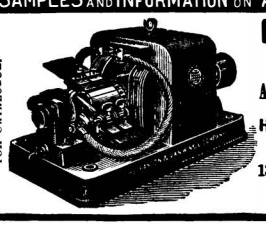

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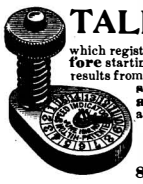

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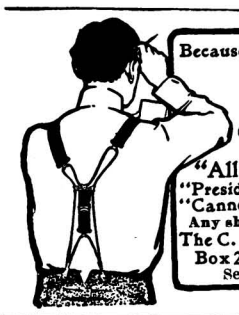

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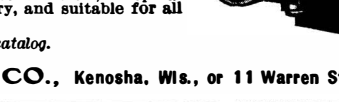

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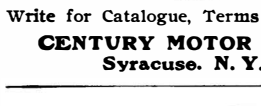

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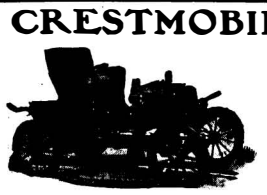

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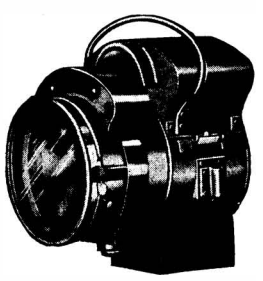

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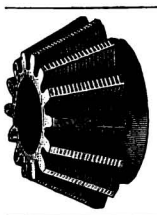

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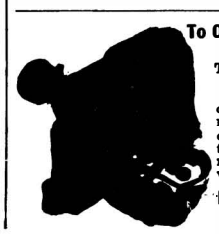

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